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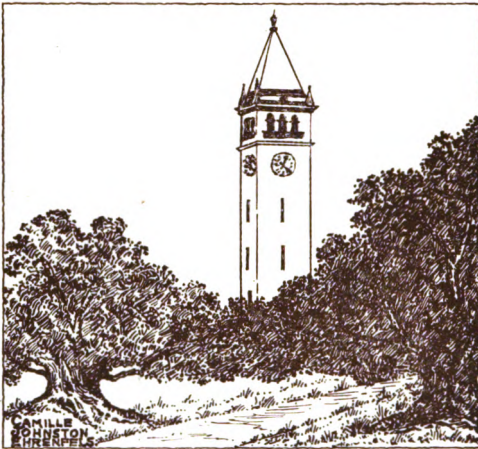
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Capt·NORMAN·C·MacKAY
CLASS OF 1936

Bombers

by the same author



BRITISH FIGHTER PLANES

BOMBERS

by

C. G. GREY

FABER AND FABER LIMITED
24 Russell Square
London

*First published in December Mcmxli
by Faber and Faber Limited
24 Russell Square, London, W.C.1
Second Impression March Mcmxlii
Printed in Great Britain by
Western Printing Services Ltd., Bristol
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Foreword to the Second Edition



Things have happened in the Far East since the first edition of this book was published in December 1941 which have led some people to question statements which I then made about the Japanese Flying Services. I take no word back of those estimates of the Japanese, in spite of the fall of Singapore and the sinking of the *Prince of Wales* and the *Repulse*.

A. There have been no reliable reports of a Japanese attack by more than 200 aircraft at a time. I allowed the possibility of 250 machines being sent to attack Singapore or Burma from Indo-China, or 500 in other directions (page 77). No such numbers have been reported.

B. All reports agree that the Japanese, whether bombers or fighters, cannot stand up to our fighters. Our Mark I, eight-gun Hurricanes have been proved superior to the Japanese copies of German aeroplanes; and American fighters of lower horsepower and armament have been able to tackle the Japanese without notable loss, if without much success.

C. British, Dutch, and American pilots have proved their superiority to the Japanese at any odds. In one raid on Rangoon our fighters brought down between 25 per cent and 30 per cent of the Japanese raiders.

D. Reports of air attacks in the Far East have obviously been exaggerated because the people are not accustomed to being bombed. The official figures for air raid casualties in Manila, Singapore, and Rangoon alike indicate that the raids were small compared with those on European cities.

E. Numbers of aircraft alone cannot stop masses of infantry and guns from overwhelming small numbers, or armies which are badly armed, badly organized, or badly led. And General MacArthur in Luzon has shown what leadership and good armament can do against bigger numbers, even when short of aircraft.

F. Dive-bombers have been proved, in spite of the reports of

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excited correspondents, to be only slightly effective and very vulnerable if met by determined and properly armed troops on the ground. For modern fighters they are easy targets, because they have to concentrate on their marks when attacking. As at Dunkerque, the troops complained that the R.A.F. did nothing to stop dive-bombing; while our fighters were slaughtering the enemy too high up and too far away to be seen.

G. In one statement I plead guilty to inaccuracy. I said, 'The Air Force has been reinforced by vast quantities of British and American aircraft.'

In spite of my experience of two wars and twenty years between, I believed official statements.

H. The Japanese proved to us that aircraft *can* sink battle-ships of the highest class. Thus the contentions of Brig.-General William Mitchell, U.S. Army Air Service, since deceased (see pp. 90 and 91) have been proved. He was dismissed from the U.S. Army for fighting for more Air Power. In February 1942, he was promoted posthumously to full General, the rank which he would have held if he had been alive in the U.S. Army.

At the same time I was abused here and in the States for supporting General Mitchell's claims and agitations.

I stand by my opinions, statements, and prophecies as William Mitchell did. Like Mr. Asquith, I merely say, 'Wait and see'.

Another point is worth making. When, if ever, this war ends we shall need air-liners. And we have none worth mentioning. To-day we need new fast troop-carriers for air-borne troops, instead of obsolete bombers. And if we had the world's best troop-carriers we should automatically have the world's best air-liners. I told the Air Ministry so two years ago.

Aircraft would do all that roads and railways can do to keep up traffic between India and China. A year ago, or more, the great Tata Ironworks, which employ tens of thousands of Indians, with a small percentage of white supervisors, offered to build such craft, if we designed them.

March 1942.

Foreword to the First Edition



This book is not a technical treatise on bombing aircraft, still less is it a discussion on the ballistics of bombing. It is not even a day-by-day history of bombing in this war. Perhaps it may best be described, in the phrase of one of the critics of its predecessor, *British Fighter Planes*, as 'an essay in discursive journalism'.

Judging by appreciative letters from people who matter, and by the generally kindly criticisms of *British Fighter Planes* in so many newspapers, people like discursive journalism as a way of acquiring knowledge. And, though perhaps I ought not to be the first to say so, I believe that anybody, from the youngest and most omniscient member of the Air Training Corps to the oldest and most experienced if dim-witted Air-Marshall, will find after he has read the book that he knows several things that he did not know before. And I hope that in acquiring that knowledge he will have had a reasonable amount of entertainment.

I do not claim this as any virtue of my own; all it means is that in the course of something over thirty years' experience of aviation in many countries I have come across most of the people who have mattered in aviation and politics, and have at one time or another written down a great deal of what they have done or said. As much of that as will go into the space allotted to this book is here to be read.

Actually the book is mostly history. Some people make the mistake of embroidering history in a flow of elegant words. I once told an historian who affected that style that even though

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the matter of history might be dry that was no reason why the manner of telling it should be wet. Consequently I have tried to tell these stories of bombers and bombings in the plain language that one uses in plain talk.

Part I of the book deals with the development of bombers and bombing from the beginning of flying until the Armistice in 1918.

Part II has to do with bombing between wars. People are apt to forget that the Flying Services (R.N.A.S., R.F.C., and R.A.F.) have never been at peace since they went to war for the first time on the 4th of August 1914. We have always had little wars going on somewhere in the British Empire. And so we started this war with a hard core of very tough, very experienced makers of air war. That was one of the chief reasons why the R.A.F. did better than the Luftwaffe from the very start.

Also in Part II there is some information of the experience gained in the wars of foreign nations. And there is a somewhat detailed history of how the Aircraft Industry of the United States developed a whole series of bombers, some of which have turned out very valuable to us in this war, although the States have had little to do with air war.

In 1917 and 1918 while the U.S. were in the last war, the only American aeroplanes which ever got to France were a modified form of the De Havilland 4, modified to take the 400 h.p. Liberty motor. But most of the senior officers in the U.S. Army and Navy Air Services took part in the last war, and many of the executives and technical men in the U.S. Aircraft Industry served in one or other of their fighting Services during that war.

They realized how badly let down they had been by the muddles in the U.S. Government Administration and in the Aircraft Industry during that time and apparently they resolved to keep very wide awake to every possible development. U.S. technical men worked in Russia while the Red Air Force was being built up and learned a great deal. They kept an eye on all our little wars and on the French Colonial Wars, and learned

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from those. And U.S. technicians were particularly closely in touch with the German Aircraft Industry.

One reason for this probably was that during the very bad times in Germany, in the inflation and under the chaotic Weimar Government, many of the most brilliant technicians in German Aviation went to the States, and made friends there. Consequently when the German Aircraft Industry grew again and started having those big Annual Conferences, there was always a strong contingent of eminent Americans present. And one noticed that a high percentage of the German aeronautical people spoke English with a pronounced American accent.

Because of that, probably, the Americans learned more about what the German Aircraft Industry was doing than did any of our people. With a few brilliant exceptions, the British Aircraft Industry and the Air Ministry technicians seemed little interested in and rather contemptuous of German developments.

Anyhow, the result was that the Americans produced dive-bombers and what they call attack bombers, otherwise twin-motor ground-strafters, types which have never existed in this country. And the Americans produced a number of different and interesting types of ordinary bombers. A history of how these were produced and who produced them will be found in those American chapters in Part II.

Part III is a general history of what bombers and torpedo-droppers have done in this war. Instead of concentrating on the history of any one line of development I have treated this part more as a general history of the war during its first two years, with special reference to what the bombers have done, and how they have done it.

Naturally such a history in a book of this kind must be superficial and sketchy. There is hardly a paragraph which one could not expand into a chapter if there were room in which to discuss points in detail and to draw conclusions from them. And naturally there has been no room in which to discuss bombing tactics, or to tell stories of gallantry of officers and men, or to

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go into the deeper subjects of the ballistics of bombs or the construction of bombs or the mechanism by which they are worked. All those are subjects for books of their own.

Part IV consists of short biographies of the men who made the British and American firms which make the bombers, or biographies of the firms as such. To each is attached a short specification of the bomber or bombers of that firm's make which have been or are being used in this war—so far as the publication of figures is allowed.

There has been no room in which to deal similarly with the German and Italian firms, and because unfortunately, the French Aircraft Industry was ruined by political muddling and meddling five years ago, so that it produced nothing which did anything in this war, I have had no excuse for saying anything of the great work which such men as Farman, Breguet, Blériot, Latécoère, and a few others did towards producing big aeroplanes which might have been useful bombers. We owed almost everything in the early days of British aviation to the French.

At the finish, with some knowledge of the subject, I should like to emphasize the words of Lieut.-Colonel J. T. C. Moore-Brabazon, Minister of Aircraft Production, when he said that we in this country make bigger and better bombers and fiercer and faster fighters than any other country. And I can only hope that in due course we may build safer and faster aircraft for passengers than any other country, and so may contribute more than any other to peaceful harmony among the nations.

To those who feel despondent, or who may be depressed by our seeming inefficiency and the clogging hand of bureaucracy and the eternal intrigues of politicians, I commend these words of Rudyard Kipling:

*If England was what England seems
And not the England of our dreams,
But only putty, brass, and paint,
'Ow quick we'd chuck 'er. But she ain't.*

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(Two 350 h.p. Armstrong-Siddeley Cheetah IX engines.)
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The Author wishes to acknowledge the kindness of *The Aeroplane* and *Flight* in lending him photographs which the makers of the various machines did not possess, and to *Flight* for lending pictures out of their files of American airplanes.

C. G. G.

Introduction



THE FUNCTIONS OF A BOMBER FORCE

Even those who, in the days of disarmament and appeasement round about 1933, regarded the growth of a big British Air Force as a form of national insanity, must now agree that, as Sir Austen Chamberlain said in the House of Commons, the Royal Air Force is our first line of battle. Obviously in any modern war the air forces of warring nations must begin fighting before the troops on the ground or the fleets at sea can meet. And even though the first contact between the air forces may be made by fighters and scouts, the big bombers must be the spearhead of the main attack.

The old phrase—‘Under God the Royal Navy is the sure shield of this Empire’—is as true as ever. That is clear when one remembers that the Navy has to assure, so far as it can, the transport of raw material and food to this country, and has to keep enemy ships from approaching our coasts, either for a big-scale invasion or for the bombardment of our coast towns. But the Navy itself has to have its Naval Air Service to protect it, so far as may be, against the attacks of enemy bombers and torpedo craft, and to do its own bombing and torpedoing. Thus the Naval Air Service may be regarded, in a way, as the spike in the centre of that sort of shield which was an offensive weapon as well as a protection.

When a war is won the winner still needs an Army of Occupation in enemy territory till peace has been fixed on his terms.

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And before that the army will be busy driving its way through enemy territory. This applies as much to any war between any two countries as to our own particular war.

But before we can call upon the Navy to escort the British Army overseas, and before we can send the Army to land on enemy territory, or in friendly countries occupied by the enemy, we must clear the way for a landing, and we must clear the air of enemy aircraft far enough inland to assure that our landing parties, and the bases which they will have to build on shore for our Army of Invasion, will not be unduly molested by enemy bombers.

Fighters have to clear the air of enemy aircraft, within their limited range of action. To our bombers belong the jobs of hampering the movements of enemy troops, destroying enemy bases and supplies, and bombing enemy troops so that their appetite for fighting will be spoiled before they meet our troops. But that is, strictly, army co-operation work. At any rate, if it is not done by aircraft under the command of the Army, it must be done under the orders of R.A.F. officers working in close collaboration with Army officers, because whatever is done must be done to fit in with the strategy and tactics of the Army.

Possibly the aircraft used for that work may, in time, be the property of the Army itself, just as the aircraft of what used to be the Fleet Air Arm have been the property of the Navy since early in 1939, after being separated from the Navy for twenty-one years—the Royal Air Force was made by combining the Royal Naval Air Service and the Royal Flying Corps of the Army into one Air Force on the 1st of April 1918.

WHERE THE BIG BOMBERS COME IN

But before the Navy or the Army can strike at the enemy's forces by sea or land, and far beyond the range of the fighters which sweep the enemy's coasts, the big bombers have to hammer away at the enemy in his own country.

Introduction

Here we shall do well to remember the axiom that offence is the best form of defence, or rather that attack is the best protection, for, as a policy, defence is the first stage of defeat. And the short-range fighter is primarily a defensive weapon.

The first job of the bomber is to smash as much as possible, and as far as possible, the enemy's sources of supply. And those vary much according to the nature of the country which one is attacking.

In this war with Germany we have struck chiefly at oil-refineries and at the chemical works where oil is made from coal, because in these days neither aeroplanes, road transport, nor shipping can operate without oil either as fuel oil for use in steam-boilers or as diesel-oil for compression-ignition engines or refined into the form of petrol or gasoline or benzine (as they call it on the Continent) for use in ordinary internal-combustion engines with electric ignition. As the oil-factories also make lubricating oil, their destruction fulfils the double object of destroying the supply of fuel for vehicles of land, sea, and air, and also assuring that they will seize up solid if they cannot get proper lubricating oil.

Our secondary targets, or at any rate our second choice of targets, have been the great railways, especially the railway junctions, and the canals, along which an enormous amount of German goods traffic is carried. In this country, when the power of The Railways (they demand two capital letters) began to grow, they were allowed to buy up all the canals and put them out of business to prevent cheap water-haulage from cutting into the profits of rail transport. In the same way the Railways did their best to secure a monopoly of road transport. And just before the war they had got control of Civil Air Transport. Probably after the war all forms of transport will be run by the Government, and our experience of bombing will then come in useful for air transport.

So far the bombing of railway goods yards, main railway lines, and weak spots in canals in Germany has done a good

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deal to hamper enemy transport of munitions and men, but probably it has had still greater effect in holding up the distribution of foodstuffs, which has much annoyed the enemy people.

In 1940 much energy and thousands of tons of bombs were spent on bombing ports in Holland, Belgium, and France from which boats or small ships might bring troops to England. These 'Invasion Ports' were reduced to a state in which they could be of little use to shipping of any kind.

From the point of view of the ordinary British citizen the most urgent targets of all have been the works in which Germany's bombers are built, and in which bombs are made, for we here likewise realize that the big bombers are the spearhead of the German attacks on us.

Bombing aircraft factories would appear at first to be the most desirable objective for heavy bombers, because if one could imagine the bomber force of any one country acquiring, with the help of its fighters, absolute command of the air, then, in spite of anti-aircraft guns, the bomber force of that country would be able to destroy all the aircraft factories of the enemy country, with the result that although the enemy might have plenty of fuel, and plenty of personnel, and plenty of aerodromes, all those things would be of no use because there would be no aeroplanes to use up the fuel or for the personnel to fly or to put on the aerodromes. And after that the victorious air force would be able to give its full attention to breaking up enemy transport by bombing, to smashing enemy munition factories, and to hammering the civil population till they were ready to give in.

During 1941 much of our bomber strength was turned on to smash the shipyards in which submarines are built, and the harbours, in what were friendly countries, in which German commerce-raiding ships take refuge. This was part of the R.A.F.'s co-operation with the Navy in the Battle of the Atlantic to assure our supplies from America and other countries.

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Another function of the bombers is to destroy enemy shipping however and wherever it can be found, and in these operations the same type of aeroplanes may be used either for dropping bombs or torpedoes. In fact the heavier machines of the Fleet Air Arm are officially known as Torpedo-Spotter-Reconnaissance types, because they do all three jobs. Consequently, we may justifiably include torpedo-droppers in this discussion.

THE FINE DIVIDING LINE

An aircraft of which we have heard much in this war is the dive-bomber, and there is some doubt about whether it belongs to the bomber or the fighter category. It is purely a short-range weapon designed primarily to attack enemy forces on the roads, or immediately in front of the line of advance of its own Army. In these days of rapid movement of mechanized troops it does, much the same thing as did the creeping barrage, invented by General Horne, with which the artillery prepared the way for the infantry in the last war.

A constant rain of bombs from the dive-bombers blasts the way clear in front of the tanks, and motor-trucks full of troops, just as the artillery barrage lifting forward a hundred yards at a time blasted the way for the slow-moving infantry to follow on behind it till they reached the enemy's position.

The navies of most nations have taken to using dive-bombers because by dive-bombing there is some hope of hitting enemy ships, which are too small in plan view to be hit from the great heights at which modern big bombers operate.

There is in fact some little difficulty in drawing a clear line between where fighters end and bombers begin. Nobody would claim that the big four-engine high-level bombers which carry up to about six tons of bombs are fighters, although they are self-protecting to a great extent. But when one gets down to the medium bombers such as the Bristol Blenheim and the Douglas

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Boston one finds that the Blenheim is used either as a long-range escort-fighter for bombers of the same type or it is used as a night-fighter when fitted with the necessary devices. And similarly one finds that the Boston, fitted with the aforesaid devices, is used as a night-fighter and called the Havoc.

Also the dive-bombers used by the Royal Navy and by the U.S. Navy are definitely called fighter-bombers or attack-bombers. They are not fast enough to be first-class fighters in the class of the Hurricane and Spitfire and Messerschmitt, let alone our new Typhoon and Tornado, but they are good enough to catch and destroy the comparatively slow flying-boats and coastal-reconnaissance seaplanes of the German and Italian Navies.

We must also refer once in a while to the flying-boats, because, although they are primarily sea-scouts they carry bombs and depth-charges, with which they have been very effective against submarines. They belong to the Coastal Command R.A.F. but they work chiefly under the orders of the Navy, and always in close co-operation with the Navy. The link between the two Services is closer because the Navy use little amphibian deck-flying boats, which are also launched off catapults. And these form the connecting link with the T.S.R. craft, the Torpedo-Spotter-Reconnaissance class which carry torpedoes or mines or bombs, spot for the ships' guns, and act as ordinary scouts.

In spite of that there is a fairly clear line which we can follow between bombers and fighters, so let us consider the history of the bombers. As in everything to do with aviation, there is some romance and quite a lot of humour in the way in which bombers have been evolved.

PART 1

Bombing in 1914-18

'Then shall the right-aiming thunderbolts go abroad; and from the clouds, as from a well-drawn bow, shall they fly to the mark.'—The Book of the Wisdom of Solomon, v. 21.

CHAPTER 1

How The Bomber Developed



Man being the predatory animal which he is, naturally as soon as the idea of flying grew, there grew with it the unpleasant idea of dropping things on people. Leaving out all the legends and coming down to comparatively modern times, we find that extraordinary genius, Leonardo da Vinci, who was at the same time one of the world's greatest painters, a brilliant anatomist, and a first-class engineer, inventing flying-machines. He invented a hot-air engine and multiple-barrelled machine-guns, and excellent designs for water-driven machinery, and so forth, but he never got quite so far as making flying-machines.

He had the idea of making an airship by exhausting the air from thin metal globes. And he also had several ideas for making a flying-machine the wings of which were to be flapped by hand-and-foot gear worked by the would-be pilot. But, although he had no internal-combustion engine in his day, he did imagine some sort of engine which would drive an aircraft into the air, and, having got so far his mind naturally turned to what could be done in the way of dropping fire-bombs on enemy towns.

I notice that those people who imagined flying-machines in the early days, before such things had been built, seemed to have more belief in attacking the civil population and, as we now say, destroying their morale, than they had in destroying enemy troops or magazines or factories. Which only shows that at any rate the people of those times did face war as war and

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did regard it as a means of destroying an enemy people without any notion of chivalry or false humanity, or, as in some cases, the sheer hypocrisy which pretends to draw a clear line between the people who are doing the fighting and the people who are making the materials with which they fight, or growing the food to keep them fighting, or making the money which pays the taxes which allow the war to go on.

WEAPON VALUE

When flying actually began in 1909 and the armies and navies of the various nations began to pay attention to flying, bomb-dropping was at once considered as a serious possibility. I will spare you the familiar quotation from Tennyson's *Locksley Hall* about 'the World's aerial navies grappling in the central blue', because that was not so much a prophecy as a platitude. Everybody saw the possibilities of aeroplanes in that way. But the opinions of professional war-makers differed considerably about how long the fighting forces of the nations would have to wait until these queer aerial toys became weapons of war and acquired what in these days has come to be known as weapon-value.

In 1911, when the French were organizing air races from Paris to Rome and Paris to Madrid and we organized a race round Great Britain, and there was actually a race round the capitals of Western Europe, including crossing the Channel twice, from Brussels to London and back to Paris, people still did not take aeroplanes seriously as weapons of war.

Those who thought about bombing at all wondered what would happen if a heavy weight were suddenly released from an aeroplane. Some argued that when the weight was released the structure of the machine, which had been deflected by carrying the extra load, would suddenly spring back to its usual shape and would probably disintegrate under the shock of the return. Which only shows what little faith aircraft designers and con-

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structors had in their own handiwork and how little they knew about the structure of planes.

THE FIRST BOMB-DROPPER

So far as I can remember or discover, the first person to experiment in this way was Claude Grahame-White, who was at that time running the aerodrome at Hendon as a money-making proposition. People to-day may be surprised to learn that the managers at Hendon, Mr. Grahame-White, the late Mr. Richard Gates, and Mr. Bernard Isaac, thought that a week-end had been bad if they did not get 20,000 people to pay at the gate to see the flying. And on great days such as the Aerial Derby or the King's Cup Race the 'gate' rose to about a hundred thousand. And that was before the War 1914-18 had wakened up John and Mrs. Citizen to the importance of flying.

Anyhow, greatly daring, Claude Grahame-White had a weight of 100 lb. fitted underneath a biplane of the contemporary pusher box-kite type and arranged it with a slip-catch so that when he pulled a string the weight fell off clear of the propeller. We who were watching this extraordinarily daring feat were greatly relieved and somewhat surprised to see that when the weight left the machine, which Grahame-White was flying at about 100 feet, so that it might get down before falling completely to pieces if anything broke, nothing at all happened to it.

Grahame-White flew round a bit, and when he landed reported that except that the machine was a little lighter to handle when the bomb fell off he noticed no difference. Which meant that whoever tied the bomb on had put it in exactly in the right place under the centre of gravity and the centre of pressure of the machine, so that it did not alter the trim of the craft while it was flying.

I cannot find that even after that either of the Services took bomb-dropping seriously. I seem to remember that we had a few demonstrations of bomb-dropping, possibly in the form of

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competitions, at Hendon and Brooklands, but certainly nobody evolved or invented or designed serious bomb-release gear or bomb-sights before the outbreak of war.

The result was that when war broke out everything had to be extemporized, and some of the extemporizations were genuinely funny, as well as being clever.

THE NAVY'S 'MAKEE-DO'

As usual the Navy led in this game of 'makee-do', or rather the curiously mixed crowd of Navy men and civilians who formed the Royal Naval Air Service.

While the Royal Flying Corps was busy retreating with the British Army from Mons, and even before that while the British Expeditionary Force was moving up towards Mons, a little detachment of the R.N.A.S. went to Belgium. The Navy proper did not want them. Commodore Murray Sueter, Chief of the Air Department at the Admiralty, who was the pioneer of Naval Aviation, had for fully three years tried to get their Lordships of the Admiralty to take an interest in flying, but they, like the higher officers of the Army, looked on it as a hobby which might develop into a sport which might after many years be of some use to the Services. So Commodore Sueter and his crew of air-going pirates were left to work out their own salvation, much like Mr. Moorshed in Kipling's story of the torpedo-boat, who was told by the Admiral, to 'go and conduct your own manœuvres in your own damn tinker fashion'.

Commander Samson, one of the first four naval aviators, chose to go cruising round Belgium with a detachment of improvised armoured cars, because he thought that he would get more fighting there than if he stuck to his aeroplanes. But Captain Louis Gerrard, Royal Marine Light Infantry, promoted to Wing-Commander, R.N.A.S., took an assortment of aeroplanes to Antwerp. And to them definitely belongs the credit of having done the first bombing of any consequence in any war.

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Here I had better explain that the first flying in any war was done in the Balkan War of 1912. An Englishman named Snowden Hedley, and a charming little Italian named Sabelli, who had both learned to fly at Brooklands in 1910-11, were engaged by the Bulgarians, along with one Frenchman and, I believe, one Russian. There was a legend that Snowden Hedley flew over Adrianople, *on* rather than in a Farman box-kite biplane, and dropped a bomb on or near the Turks, but I was never able to verify the fact. At any rate there was no serious bombing in that war. But Snowden Hedley served in the R.N.A.S. in 1914-18, wearing a Bulgarian war-medal.

Also the Italians used some aeroplanes in their war against the Turks in 1913, by which they acquired Cyrenaica. But there is no authentic account of bombing.

The bombing which was organized in Antwerp was quite serious. The bombs, as I remember them, weighed as much as 25 lb. each. The aeroplanes from which they were dropped were Sopwith biplanes with 80 h.p. Gnome engines and they had a top speed of about 80 m.p.h.

The bombs were carried in a thing exactly like a pipe-rack fixed on the outside of the fuselage, handy for the pilot or passenger. They hung nose downwards and the stems of the bombs projected up through the holes in the pipe-rack arrangement. There a pin was stuck through each stem and rested across the hole. To the head of the pin a piece of string was tied, and when the bomber wanted to drop the bomb he pulled the string which pulled out the pin which let the stem of the bomb drop out of the pipe-rack, and the bomb fell.

Nothing could be simpler, and the result was not so much more inaccurate than bombing by a modern aeroplane the crew of which have been badly shaken by anti-aircraft gunnery and attacks by night-fighters. At any rate the average accuracy of bombing in 1914-18 was just about as good as is the average of German bombing to-day, assuming that one guesses rightly at the targets which they intended to hit, and gives the Germans

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credit for the supposition that they did aim at a target and did not drop their bombs at random, which is evidently what about 90 per cent of them have done.

Even to-day bombing is a gift rather than a science. A good shot will shoot well with a cheap gun and a bad shot will shoot badly with one of Purdy's best sporting guns. Bombing is like that.

Those primitive bombs at the end of 1914 had few refinements, such as methods of arming the fuses just before letting the bomb go, or safety devices or anything of that sort. If a bomb fell out of the pipe-rack while the machine was standing on the ground, because the vibration of the engine jolted the pin out of the hole, that was just too bad for the pilot of the aeroplane, especially if he happened to be sitting in it. Not until some time afterwards did we reach that stage of sophistication in which a bomb had to fall some distance to release the firing-pin by the revolution of a vane on the tail.

THE FIRST EFFECTIVE BOMB-RAID

Nevertheless that Belgian bombing was quite effective. Flt.-Lieut. R. L. G. Marix flew from Antwerp to Düsseldorf in a Sopwith biplane, and by sheer good luck there happened to be a Zeppelin airship in the shed. The bomb happened to go off as intended and the airship went up in flames with the shed. Marix dropped his bomb from a matter of a hundred feet above the shed, and had the luck not to be caught up in the resulting explosion. Anyhow he returned joyously to Antwerp.

On the same day Squadron-Commander Spenser Grey, in another Sopwith biplane, bombed the railway station at Cologne. Just how much damage those little bombs did to a vast edifice such as that station one cannot imagine. Probably they broke a good deal of glass, and undoubtedly they caused considerable upset among the railway staff.

Anyhow, the bombing was confirmed by our spies, and both

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Marix and Grey were made Companions of the Distinguished Service Order for doing the first effective bombing in the war. They were also given Belgian and French decorations.

A day or so later Wing-Commander Gerrard by himself, and Squadron-Commander Grey with Flt.-Lieut. Newton-Clare in a two-seater set off in a fog to see whether they could find any more Zeppelins.

How people navigated in those days without blind-flying instruments and all that must seem appalling to modern pilots, especially when there is added the still more uncomfortable fact that there were no parachutes, so that one could not bale out in a fog and leave the machine to crash into somebody's house. One just had to sit there and take the collision with it. On the other hand those Sopwiths could land at about 30 m.p.h., so one could lessen the shock compared with that of a modern machine which touches down at 100 m.p.h. or so.

The pilots of the two machines were completely lost, but they managed to get back to the Antwerp Aerodrome. When Spenser Grey and Newton-Clare landed they saw a vacant space in the pipe-rack which showed that one of the bombs had vibrated itself off. They only hoped that it had fallen in Germany and not in Belgium.

After dinner they were sitting in the lounge of their hotel—war was a comfortable game in those days—when an excited Belgian Staff-officer dashed in and told them that a complaint had come from the Dutch Government that one of the Allied aeroplanes had dropped a bomb in the city of Maastricht, and had blown up a school and some houses and had killed a lot of women and children, and that the Dutch Government were seriously contemplating declaring war on Belgium. Spenser turned to Newton-Clare and remarked, 'That must have been a damned good bomb.' He knew just about the capacity of those bombs. Curious how, even in those days, bombs, as Lord Trenchard remarked in the House of Lords a year or so ago, seemed to be particularly attracted by women and children.

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The next day the Germans came so near to Antwerp that our people had to clear out, and the errant bombers did not hear for several weeks that they had in fact flown over that southerly projection of Holland which lies across a straight line from Antwerp to the Ruhr, and that the bomb had fallen in a street in Maastricht. But the only damage it did was to make a few marks in a brick wall, which was, in fact near a school. Nobody was hurt.

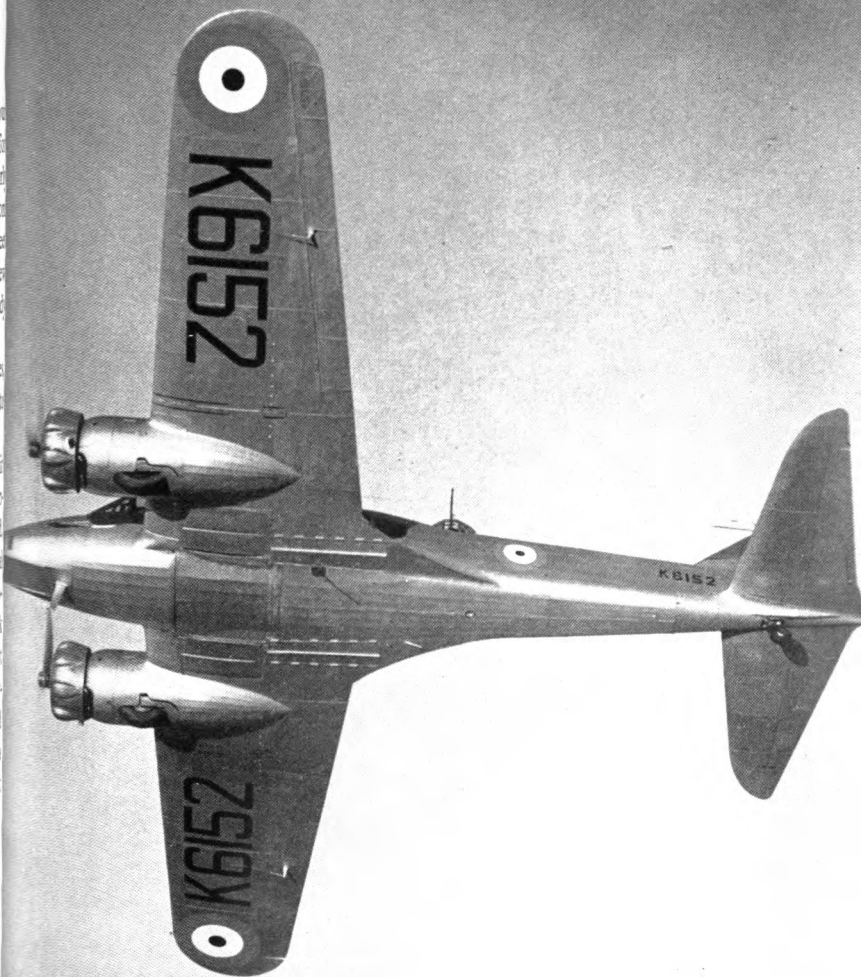
I like that story of one of the world's first bomb outrages, for the difference between the report and the fact helps one to get so many war rumours into proper perspective.

Shortly after that another officer of the Royal Naval Air Service, Flt.-Commander Bigsworth, destroyed another Zeppelin. The airship came over Belgium after a visit to England, and Bigsworth went up in one of those funny but immortal Avro 504 biplanes with a somewhat similarly primitive bomb-rack, got over the top of the Zeppelin, and by combined luck and judgement dropped a bomb into its tail. The bomb went off all right and so did the tail. For some queer reason the airship did not catch fire, but it went completely out of control and crashed on top of a house, which, if I remember rightly, was a nunnery or a convent school. And I think that Bigsworth got his D.S.O. for that. Anyhow he got one.

THE ZEPPELIN FACTORY RAID

The next real bombing was quite an exciting affair. Already by November 1914 Zeppelin airships had become a nuisance, and to many people a terror, by dropping bombs on this country, and little could at that time be done to stop them.

Mr. Noel Pemberton-Billing, whose name is nearly as well known to-day as it was in 1916, when he went into Parliament,





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had joined the R.N.A.S. right at the start of the war and had organized an anti-aircraft unit. He had only wooden guns and his armoured cars were plywood, when he was sent to guard Windsor Castle, but the moral effect on the people was good. He was smitten with the idea, possibly inspired by Reggie Marix's raid on Düsseldorf, that a raid on the Zeppelin Airship Factory at Friedrichshafen would be a Good Thing. So was Commodore Murray Sueter when P.-B. put the scheme up to him. And as the Commodore was never afraid of taking the initiative or a responsibility he gave Pemberton-Billing a free hand to go ahead.

So P.-B. got hold of three Avro biplanes with 80 h.p. Gnômes and had them fitted with a most superior kind of bomb-rack which carried bombs of 50 or 100 lb. weight underneath the fuselage and released them when a Bowden wire was pulled. The machines were assembled and packed in plain cases at the Avro factory at Manchester and shipped secretly to France.

In the meantime P.-B. had gone into Switzerland on a faked passport and had had a good look at Friedrichshafen from Romanshorn on the other side of the Bodensee, or Lake Constance as we call it. He got plans of the works from a man who habitually went there, and he nearly got himself arrested as a spy by the Swiss. He and his friend Brock, of Brock's Fireworks, who was afterwards killed on the Mole at Zeebrugge, did a terrific drive over ice-bound roads across France from the Swiss frontier, and met the machines in their cases at Le Havre.

There he found that he could get little help from the French. But in a few hours he had whatever there was in the nature of British Naval personnel, including a couple of regular Commanders R.N. with their coats off, heaving the cases off the ship and onto railway wagons. Then he set off, armed only with a letter of introduction from Commodore Sueter, to the Head-

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quarters of General Joffre, who was then Commander-in-Chief of the French Army. How he managed to be eloquent through an interpreter I do not know, but his eloquence won for him an all-powerful pass from General Joffre, and in a few days he had those cases stored in the big airship shed at Belfort, the great French frontier fortress.

Everything was deadly secret. They rigged the machines in the airship shed, they never took them out for a trial flight, and on a certain morning the three machines set out piloted by Squadron-Commander Featherstone Briggs, an Engineer-Lieutenant R.N., one of the pioneers of naval aviation; by Flt.-Lieut. John Babington, a Lieutenant, R.N.; and by S. V. Sippe, a civilian from Brooklands who joined the Reserve of the Royal Flying Corps and became an officer of the R.N.A.S. just before the outbreak of war. The three of them got to Freidrichshafen, and dropped their bombs around the works, but unfortunately without setting anything on fire.

Briggs was shot-down with a bullet in his engine, but landed unhurt. Babington and Sippe got back to Nancy.

Briggs was a prisoner in Germany for about a year. Then he escaped, rejoined the R.N.A.S., and continued to do good service for many years afterwards.

The good of that Freidrichshafen raid was that it so scared the German High Command that they kept some 4,000 men constantly on duty there with anti-aircraft guns in case of a serious raid and a possible landing of troops. Even in those days German intelligence realized the possibility of raids by air-borne troops. The pity was that we disappointed them. And, more curious still, although three primitive 80 h.p. Avros managed to get to the Zeppelin factory in 1914, the French made no effort to destroy it in the following four years, when real bombers existed.

All three members of this raid were made Companions of the Distinguished Service Order and Members of the Legion of Honour.

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There is also interest in recording the fact that to-day John Babington is an Air-Marshal, and after commanding the R.A.F. at Singapore in 1941 was put in charge of the Technical Training of the R.A.F. at Home. Marix in 1941 was an Air Vice-Marshall commanding a group in the Coastal Command. Louis Gerrard retired from the R.A.F. some years before the war as an Air-Commodore. Spenser Grey became a Lieut.-Colonel in the R.A.F., when the R.N.A.S. and R.F.C. were combined, and retired with that rank, crippled by a series of crashes in aeroplanes during the war. He was killed a year before this war in an accident not concerned with flying. Newton-Clare retired as a Major and is now in the Ministry of Aircraft Production. Featherstone Briggs retired as a Group-Captain, and is a director of Tecalemit Ltd. Sippe retired as a Major, R.A.F., and did well in business.

The interesting point is that those pioneers of bombing, after going all through the last war and most of them doing many years of flying since then, should, except one, still be alive. I do not think that it proves anything other than the influence of luck or the vagaries of fortune.

CHRISTMAS DAY BOMBING, 1914

After those successes by the R.N.A.S. the Army began to sit up and take notice, and the Royal Flying Corps considered bombing seriously. And so did the Germans.

The Friedrichshafen raid was in November 1914. Not long before this war started I was discussing this question of early bombing with a German pilot of the last war, and remarked that they were rather slow in taking to it. He replied that at any rate he himself had dropped a bomb on Paris on the 4th of September.

The first bomb to be dropped in this country was dropped by a German aviator somewhere around Dover on Christmas Day, 1914. That is worth remembering because it is the first

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bomb raid on Great Britain—and, with due respect to our Celtic fellow-subjects, let us say on England. They had the honour in this war in that the first German bombs fell on Scotland—if the Orkneys be so.

Christmas Day, 1914, was also remarkable because on it the first bomb-raid by seaplanes was made.

Quite early in the war three cross-Channel steamers, the *Empress*, the *Riviera*, and the *Engadine* had been commandeered by the Air Department of the Admiralty and turned into seaplane carriers. The Short Brothers, then at Eastchurch in the Isle of Sheppey, had built in 1913 float-planes with folding wings so that they could be carried on board ship—which shows how far-sighted were the engineer officers of the R.N.A.S.

This country does not know yet how much it owes to Engineer-Lieuts. Gerald Aldwell, Featherstone Briggs, Charles Randall, and Wilfred Briggs. They were Commodore Murray Suter's technical advisers in those early days, and I cannot remember that they ever made a mistake in their technical decisions. I emphasize that point because the R.N.A.S. developed bomber aeroplanes long before anyone else did.

On Christmas Day, 1914, the three little Channel packets were off the Friesian Islands, and, by good joss (the Navy's own kind of luck), the R.N.A.S. had a fine day for its job. They lowered their Short float-planes over the side with the wings spread, and bombs properly held in proper bomb-racks under the fuselage. Wonderful progress had been made in bomb-racks in those three months since Antwerp.

The pilots managed to get, even in those primitive machines, as far as the great ports of Cuxhaven and Wilhelmshaven and dropped their bombs on anything that looked good. I do not think that our spies reported that any damage was done that mattered, but the pilots and their passengers had a wonderful time.

Squadron-Commander Frederick Bowhill commanded one of the ships. From the beginning of this war until well on in

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1941 Air Chief Marshal Sir Frederick Bowhill, K.C.B., D.S.O., and a whole lot of other decorations, was Air Officer Commanding-in-Chief Coastal Command. He went to America, promoted to G.C.B., in the middle of 1941 to organize the delivery of American aircraft to this country.

One of the pilots, Flt.-Lieut. Douglas Oliver, after loosing off all his bombs on German warships in Wilhelmshaven roads, found himself over the battleship *Von der Tann*, and as he had nothing else, he hurled at it his gollywog mascot, which he tore from an interplane strut.

Flt.-Lieut. 'Chekko' Hewlett, son of Maurice Hewlett the novelist, also a Lieutenant, R.N., lost his way on the homeward trip, alighted in Dutch territorial waters, and was rescued by fishermen. There was much argument about whether he should be interned for the duration, but the Admiralty pleaded that he was a shipwrecked mariner and should be treated as such, which he was.

A passenger in one of the machines was Flt.-Lieut. Erskine Childers, who a few years before had written that remarkable book *The Riddle of the Sands*, which foretold the invasion of England by shallow-draught barges, precisely as the German High Command planned in this war. Childers had joined the R.N.A.S. because of his interest in a possible German invasion and because he saw what air power could do to stop it. By way of a compliment he was taken on this raid over the very islands about which he had written.

After serving with distinction in the war, chiefly in the Mediterranean, he went 'Bolshie', as we called any departure from normal in those days, joined the Irish Sinn Feiners, and was shot as a rebel. Chekko Hewlett was farming in New Zealand when this war began and I believe is working hard for the New Zealand Air Force. Douglas Oliver died as a Group-Captain a few years ago.

In spite of all this bombing activity in those first five months of the war the development of serious bombing progressed

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slowly. Something like proper bomb-racks were evolved. Much ingenuity was spent on the improvement of fuses, to make bombs safer to handle on the ground, and so forth. But we were very slow in building big aeroplanes for the express purpose of bombing.

All the heavy bombing in the first year and a half of the war was done by the German Zeppelin airships. They came over England and Scotland regularly. We developed anti-aircraft guns, and night-flying fighting aeroplanes of sorts, and a few were shot down. But we could not retaliate by bombing Germany.

Our aeroplanes were used for tactical bombing in the fighting areas, and those machines which did the most bombing were designed for something else. The Royal Aircraft Factory designed the F.E.2b pusher biplanes, first of all with a 120 h.p. water-cooled Beardmore engine and then with 160 h.p., as fighters, with a gun in front. Then when the Rolls-Royce people produced the Eagle engine of about 350 h.p. they put that into a machine which they called the F.E.2d. All the F.E.s carried a respectable load of bombs for their power, but they were still two-seat pusher fighters.

The Aircraft Manufacturing Company produced the D.H.4, an elegant and fast tractor biplane, but that was more of a two-seat reconnaissance fighter, although it carried bombs. The Sopwith Company produced the famous '1½-Strutter', which was the first machine in which the gunner sat behind the pilot with a gun on a Scarff ring which could swing all the way around about three-quarters of a circle. That carried bombs and did good work with them, but it was primarily a fighter.

Actually the first real bomber of the war was the Handley-Page twin-motor O/400 biplane.

How the Bomber Developed

THE HANDLEY PAGE BOMBER

Frederick Handley Page started life as an electrical engineer, and, like his great friend and rival, C. R. Fairey, he became a lecturer on engineering. When I first met him in 1909 he was lecturing at the Northampton Polytechnic, somewhere down Clerkenwell way, and his aircraft factory was a shack of boards and corrugated iron at Barking on top of the dumps which were made alongside the north bank of the Thames from the soil which was excavated when making the London tube railways. Being dump land the rent was low.

By 1914 he had established his name as a serious builder of aeroplanes, and during the first year of the war he was building for the Admiralty. I think that he was making B.E.2c's for them at first. But quietly he was working on the designs for a real bomber with two motors, which was called the O/100.

There had been multi-motor machines before that. Before the War 1914-18 Mr. Igor Sikorski, who is now, I believe, a naturalized American citizen, had built a vast biplane near St. Petersburg (now called Leningrad) which had four motors in a row along the lower plane. It flew, but I never heard that it did anything, although it was obviously intended to drop bombs some day.

Also in the very early days of the war at Hendon a young officer of the R.N.A.S. named G. M. Dyott, who afterwards became famous as an explorer in Peru and Brazil, built a two-motor machine which flew fairly well. But it never was quite good enough to go on active service or to be built in quantities.

That was where Handley Page scored. His biplane had a short lower plane and an upper plane which projected far out on either side. It had a very deep body, or fuselage, and it had a biplane tail. Where he was most lucky was that he managed to have Rolls-Royce Eagle motors of about 350 h.p. apiece allocated to him.

Admiral Sir Murray Sueter, M.P., as he now is, said not long

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ago that when Handley Page came to him with this proposition he sized him up and said to himself, 'Here is a man who can deliver the goods.' Most people in aviation know that H.P. is one of the world's finest salesmen, but even his worst enemies cannot deny that he delivers the goods. And the O/400, which was the official title of his bomber, developed from the O/100, certainly was good goods.

CHAPTER 2

Our Bad Beginnings



One might in fact sum up the course of the development of British aeroplanes during the War 1914-18 by saying that we started with practically nothing in August 1914; in 1915 we were making mostly the wrong things, but trying hard to find what was the right thing; in 1916 we were making the right stuff but were not ready to deliver it; and our delivery of the aeroplanes which won the war began round about Eastertide, 1917.

And here an odd but sad fact must be recorded. We seemed to make a practice of presenting to the enemy a sample of every new type of machine we produced as soon as it went to France.

On the 2nd of January 1917 the first Handley Page bomber, with two 350 h.p. Rolls-Royce engines, which went to France, was sent to join a detachment of the R.N.A.S. under Captain Elder, R.N., which was operating from Luxeuil, near Nancy, another of the great French frontier fortresses. At that time the fighting line ran from Nieuport, north-east of Dunkerque, south-by-east to Noyon, and then practically due east to near the German frontier, where it turned south again to the Swiss frontier. That made practically a right-angle corner at Noyon.

As the machine approached this corner it ran into a thunderstorm, and, as in those days there were no blind-flying instruments or gyroscopic compasses, the pilot lost his direction.

When he came out of the clouds he came down low to try to

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find where he was. Seeing some French soldiers working in a field he landed to ask his way. Then he found that he was inside the German lines and that the French were prisoners. Before he could take off again German troops came up and collared him and the officer and three mechanics who were with him. They had not even time to set fire to the machine.

At Easter, I think on Good Friday, the first squadron of the new Bristol Fighters to reach France was sent over the lines under Major Leefe-Robinson, V.C., who had brought down a Zeppelin some months previously. The squadron was made up of six experienced pilots with inexperienced gunners, and six inexperienced pilots with experienced gunners. The Commanding Officer might justly be classed as inexperienced, because, although he had done so well over England, he had not had any fighting experience in France. Of the twelve machines only two came back. One experienced pilot got away with it on sheer flying and one experienced gunner saved his pilot. The Germans had ten of our very latest and best aeroplanes to examine. Major Leefe-Robinson was a prisoner in Germany, and died of influenza after his return to England.

On the Easter Monday a squadron of our newest single-motor bombers, the D.H.9 biplane with the 220 h.p. B.H.P. (Beardmore-Halford-Pullinger) engine, was sent to bomb a bridge away behind the enemy lines in Belgium. The pilots worked out that provided the wind did not get up from the west they could just make the journey on all the petrol they could carry. They ran up their engines on the ground to warm them. Then they topped up their petrol-tanks to the filler-cap. And off they went.

About the time when they should have come back one machine was seen gliding down with the air-screw stationary, 'a dead stick' as we called it, and it crashed in No-Man's-Land between the British and German lines. I think that the pilot and gunner got away. Another machine was seen to land with a dead stick in the far distance. None of the others was seen

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again. The wind had sprung up. And that was the first appearance of the D.H.9 in France.

Sending a squadron of new and untried machines to do that job was crazy, but in those days the R.F.C. was just part of the Army and squadrons were attached to Divisions or Corps as the Army needed them. It had nothing to do with the R.F.C. Command at all, although when Major-General Hugh Trenchard succeeded Lieut.-General Sir David Henderson, he did manage to conduct his operations in his own way. The Brigadier-Generals who commanded Brigades in the R.F.C., and the Group and Wing Commanders naturally had tactical and administrative command of the R.F.C. Squadrons under them, but when the Army wanted a bridge bombed or an attack made, the R.F.C. Command had to see that it was done.

Another of these unfortunate incidents in which we gave away a new type had a comic side to it. The Royal Aircraft Factory (now Establishment) at Farnborough had produced a machine called the F.E.2d, a superior edition of the original F.E. (Farman Experimental, or Fighter-Experimental) pusher biplane which had a 350 h.p. Rolls-Royce Eagle engine instead of the old 160 h.p. Beardmore. The first of these was sent out with an R.N.A.S. pilot to be inspected by the R.F.C. Staff at their headquarters at St. Omer, which is not far from Calais. When the pilot was about to start a Staff-officer of the Regular Army came along and asked him whether he would give him a lift to St. Omer, as he was returning to France from leave. So the two set off and their departure was duly telegraphed to R.F.C. Headquarters at St. Omer, where everybody was looking forward to seeing this latest creation of the R.A. Factory.

In due course the machine hove in sight and the expectators on the aerodrome cried, 'Here he comes! Here he comes!' The machine came straight overhead and passed on, and the expectators turned round and exclaimed with astonishment. 'There he goes! There he goes!' The pilot went straight on, instead of

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circling back to land, and in due course landed on the aerodrome at Lille, which was the Headquarters of a German Army. As soon as he touched the ground he saw that the machines and the people around were German, but unfortunately he had buckled a wheel in landing and nosed over onto a wing-tip. And the Germans had another sample of our very latest.

The Personnel Department of the War Office was greatly troubled about a Staff-officer of the Army having flown without authorization with a Naval pilot to France. So, to regularize the affair, they went to the trouble of gazetting him to the R.F.C. while he was a prisoner of war. I always regard that as one of the best examples of the Puritan, not to say Futilitarian, methods in our Government Departments.

FRENCH BOMBERS

The French were, in fact, a little before⁷ us in building twin-engine bombers, but they were of little use. The Caudron Frères made a comic little biplane creature which lifted a large weight with its two 80 h.p. Gnômes, but it had only as much power as the F.E.2b with one 160 h.p. Beardmore.

The French also had at the beginning of the war a machine which had possibilities if it had been developed. It was a very large single-motor biplane, designed and built by a M. Paul Schmitt—no relation to Messerschmitt of to-day. The whole wing-structure was built onto an enormous steel tube which was carried like an axle in big bearings, across the middle of the fuselage or body, in which the axle was revolved by a worm-gear and a handle.

When taking off with a big load the observer, or passenger, screwed the gear round so that the wings presented a more obtuse angle to the air than they would when flying normally. The result was that the machine got a big lift for take-off while still keeping the fuselage and the tail at a reasonable angle to the ground and to the air. When the machine was well up the pas-

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senger screwed the wings back to their normal position in relation to the line of the fuselage and it flew faster.

There was a lot of argument about whether the advantage of having a bigger angle at which to take off was compensated by the extra weight of the gearing. But then we have had the same argument about retractable under-carriages, variable-pitch air-screws, and gun-turrets, and everything else which has compelled the designer to add more weight to get a better performance. A neater variant of the Paul Schmitt idea was patented years later by the great Sir W. G. Armstrong-Whitworth Aircraft Company Ltd., of Coventry, who are now famous as makers of the Whitley bombers and other notable warcraft.

Unfortunately only one Paul Schmitt of that type was made, and after a few experimental bomb-raids over the German lines it disappeared and was never seen again. I believe the French did not even hear what happened to it. And they never built any more.

Although the French did a lot of bombing by the simple process of slinging bombs great or small, under their wings or fuselages, their twin-engine bombers never amounted to much. Although the French had magnificent young fighter-pilots, and amazingly brave middle-aged bomber-pilots, the French *Service d'Aviation* as a whole could not be regarded as first-class. The proof of that was that when a German squadron had been badly mauled on the British Front it was sent down to the French Front for a rest.

If anybody wants reliable confirmation of the lack of organization in the *Service d'Aviation* I recommend them to read *Prelude to Victory* by Brig.-General Spears.

EARLY GERMAN BOMBING

The Germans went in for bombing quite seriously in the early days of the war. In 1915 a mysterious machine which had two fuselages, and was known to people in France as Two-Tails, ap-

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peared over our lines. It turned out later to be an Aviatik. It had a *nacelle*, or cradle, between the fuselage, with a machine-gun in front and another behind, it carried bombs strung along under the lower plane, and it had an engine in each fuselage.

For some curious reason the type was never developed during the last war and nobody did anything about it until about four years ago. Since then several of the two-tails type have been built. Anthony Fokker built two successful types. The Germans have tried one. And the Lockheed Lightning, a twin-motor, single-seat high-speed fighter, is also of the two-tail species.

THE NOTORIOUS GOTHA

By 1916 the Germans were taking their bombing very seriously. The Gotha Wagon Works, which primarily made rolling-stock for the railways, had produced the notorious twin-motor Gotha biplane, which acquired almost legendary fame in Britain. Whenever anything came over at night people assumed that it was a Gotha just as to-day they assume every German fighter is a Messerschmitt.

The Gotha was a very good aeroplane. First of all, as it had two pusher-screws it was more efficient than any of the tractor-machines of its day. It had skilfully balanced ailerons and rudders which made it very controllable for its size, and its manoeuvrability was improved by massing the bomb-load and petrol well on the centre of gravity, so that, in spite of having the motors set between the front and rear spars, with the propellers close to the trailing edge, and close to the fuselage, the nose of the machine was not excessively long. That result was also got probably by making the fuselage very short, in proportion to the span. And, as the photographs of to-day show, apparently it had a very light tail-unit—that is, tail-plane, fin, rudder, and elevator.

Presumably warned by the casual way in which we presented samples of our latest models to them, the Germans decided, as

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it were, to 'try it on the dog', and sent the first squadron of Gothas to raid Bucharest. The Rumanians were still fighting at that time and had not made their masterly retreat to Jassy.

Our spies soon told us about the Gothas and naturally we had messages from Bucharest with terrible tales of the effect of the bombing. And the next thing that we learned was that the Gothas were going to bomb Salonika, the Headquarters of our Army in the Balkans.

At that time the R.F.C. at Salonika was commanded by Lieut.-Colonel George Dawes. Under him was a young officer named Murlis Green, who had been sent out from France shortly before. He had persuaded Colonel Dawes to let him turn a B.E.2c into a single-seat fighter.

When word came from the front line, on the 5th of March 1917, of the approach of the Gothas he went up to meet them. He was a wily young man, so instead of sailing in haphazard behind their tails, and being shot by the aft guns of the Gothas, which were flying in close formation so that they could concentrate their fire on any such attacker, or trying to attack them from underneath and being shot down by their belly-guns, which fired downwards and backwards (a wonderful novelty in those days), he invented a tactical evasion. In his light single-seater, which the German scouts took to be the usual innocuous B.E.2c, he climbed up above the Gotha formation and dived into the middle of them.

There he levelled out on the tail of the leading machine in such a position that none of the Gotha gunners could fire at him without the danger of hitting one another. And as there was no short-range radio in those days by which the commanding officer could issue orders to his own men, none of the German pilots or gunners knew what to do about it.

After a few minutes in his precarious position in the middle of the German formation, Murlis Green hit an engine in the leading machine so that it had to make a forced landing. He, wily as aforesaid, sat tight on its tail and followed it down so

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that the gunners in the next machine in the formation could not shoot at him without shooting their comrades. And so the machine landed practically undamaged, and Green landed alongside his prize.

The rest of the Gothas reached Salonika, but, I believe, did little harm. And the undefeatable Murlis Green went up again and got a second Gotha on their way back. His performance won for him a well-deserved Military Cross and a French Legion of Honour and a Serbian White Eagle, and marked him for further attention.

That was how we got to know all about the design and structural details of the Gotha before the first Gotha had raided England.

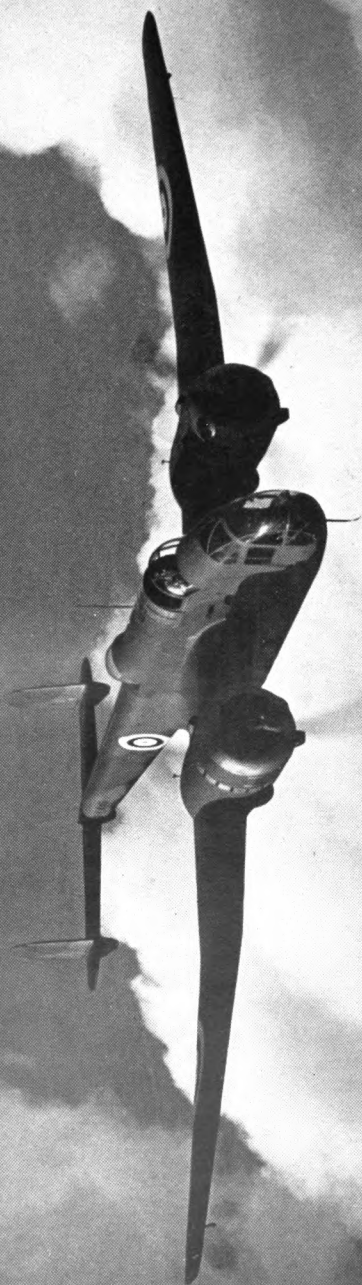
GETTING THE GOTHA'S FIGURES

When the Gotha raids on England began, at first they used to come over boldly in daylight, relying on their three gun-positions—nose, midships, and belly—to protect them when in close formation. Apparently they used to start somewhere in Belgium, and generally they came in over the coast somewhere around Dovercourt or Harwich, and always they used to go for London.

Naturally what the R.F.C. and the Archie gunners wanted most to know was the normal height at which loaded Gothas flew, and their speed.

One day a young officer named Henry Tizard, who was an experimental test-pilot at Orfordness, north of Felixstowe, because he was too blind to be a fighting pilot in France, and happened to be an Oxford man of much scientific attainment, was up testing one of our newest fighter-bombers, I think a D.H.9, with full war equipment. In the direction of Felixstowe





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he sighted a formation of Gothas and proceeded to chase them.

He sat himself nicely out of range of the tail guns of the rear-most Gothas and noted the performance of the formation. His machine was equipped with hydrometers and hygrometers and barometers and thermometers and altimeters, and every sort of scientific instrument to measure the humidity temperature and density of the air. He wrote down the figures for all this carefully on his knee-pad, corrected the figures for temperature, humidity, etc., put them in a message-bag addressed to the Commandant at the Experimental Station at Orfordness, and dropped the bag overboard attached to a parachute. But before putting the message in the bag he wrote underneath, 'I now propose to engage.' And he sailed in and fought until his ammunition was gone.

Lieut.-Colonel Sir Henry Tizard, Dean of the University of London, and a member of the Air Council, to-day acknowledged to be one of our leading scientists, told me that this story, which I had previously told in print, was not strictly accurate. But he would not tell me wherein it was inaccurate; he was too modest even to do that. So I merely give the story as it was told to me by one who was serving with him at that time at Orfordness, and he added that Tizard came back with his machine full of holes.

Anyhow, between him and Murlis Green, who I believe is now an Air Commodore or an Air-Marshal (the Air Ministry no longer publishes the Air Force List), we came to know just what we wanted to know about the Gothas. Thereafter the gun barrage and the fighters of the London Air Defence Area, under Major-General E. B. Ashmore, dealt adequately with the Gothas. They took to night-flying as well during 1917, and we in return developed night-fighters, mostly Sopwith Camels, and Major Murlis Green, who had come back from Salonika with

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‘Several squadrons of bombing aeroplanes in the R.N.A.S. have been attached to the French Army somewhere on the extreme right wing of the Allied Forces, and on occasion have, in company with French aviators of distinction, visited German munition centres beyond the Rhine.

‘Elsewhere, during the year [1917] long-distance bombing raids have been made in remoter parts of the earth, and the blessings of an inspired civilization have penetrated to the homes of the poor no less than to the mansions of the favoured rich. Turkey in Europe has known the bombs of the invader no less than the plains of Palestine. The negroes of East Africa are as acquainted with the intricacies of high explosives as are the dervishes of the Egyptian desert and the descendants of Haroun-al-Raschid.’

William Whittaker in that line came near being as purposely pompous and solemnly funny as was the late Mr. Gibbon, whose *Decline and Fall of the Roman Empire*, besides being one of the world’s greatest histories is one of the world’s greatest humorous works.

Later on Major Whittaker, who was a sound soldier, and a valued member of the Staff of General Ashmore, when he organized so successfully the London Air Defence Area which ultimately defeated the German bombers, wrote:

‘Of late days, bomb-dropping from aircraft has ceased to be an amusement, and has become a serious incident of the common day. No longer is the distribution of bombs casually undertaken on the flatter days of the war. No longer is the extinction of a few Germans foolishly collected at a convenient place a proper object for the bombing aviator. To-day the bombing of a position is carefully ordained, and undertaken with due consideration of the results to be obtained.

‘The areas at which careful destruction will bring the greatest trouble to the enemy disposition are selected, and attacks are made with due regard to the value of concentration. Lines of communication on days of stress are objects of joyful attack.

A 1917 Commentary on Bombing

and here again the aeroplane is directly of assistance to troops in action. But bomb-dropping only retains its value when it is an integral part of the operations in general. Without a definite tactical or strategic object it is valueless and probably injurious as it takes a number of aeroplanes away from duties more proper to their powers.'

Later still, writing of the bombs themselves, he says: 'During the year a great advance has been made in the design and construction of bombs distributed by aircraft in their journeys over enemy territory. The earlier bombs were heavy and of uncertain habits in comparison with their powers of damage on detonation.

'Such injury as they inflicted was local in effect and a very high percentage failed to explode on reaching the target. Others exploded too soon, and in consequence caused destruction in the establishment of friendly personnel.

'Bombs, and the means of distributing them effectively, are more restricted than is the case with shells and should be capable of the highest destructive powers commensurate with their weight. They are not subject to initial strain, as in the case of a shell when it is fired from the gun. They have great penetration, thus weight for weight bombs can be constructed of far greater destructive power than a shell.

'Much use has been made by the Germans of a type of incendiary bomb which on detonation releases a quantity of highly inflammable material over a fairly large area. Little damage is done by the explosion itself, hence such bombs should be complementary to those charged with high explosive.'

And that, remember, was twenty-four years ago.

A curious and interesting fact is that the Italians had actually produced by the beginning of 1917 a better bomber than the French had. That was the Caproni three-engined biplane, which had two 80 h.p. Gnômes as tractors and a 90 h.p. Curtiss water-cooled engine driving a pusher-screw at the back of the nacelle. The machine had two tail-booms or fuselages, and

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thus was also of the two-tail type. Later on three Isotta-Fraschini engines were fitted.

Another curious point in its design was that it had a kind of double tricycle under-carriage. In those days people could not make the enormous pneumatic tyres which are made to-day, so Gianni Caproni fitted two wheels side-by-side to each leg of the under-carriage and two side-by-side under the nose-piece. So it really had six wheels arranged tricycle-fashion, and it landed with its tails up, resting on the nose-wheels. But it could, if desired, sit on its tails.

BOMBER PROGRESS IN 1917

Writing in 1918 of the work done in 1917, Major Whittaker says:

‘In the summer the aerial forces in the field began on the Western Front the series of long-distance bombing-raids demanded so insistently in the House of Commons. The R.N.A.S., to which the art of bomb-dropping was particularly attractive, began in July to make life in the German aerodromes in Flanders an episode with no joy in it at all. Tons of bombs were unloaded with a profusion which precluded the necessity of accuracy of aim, into all those places set aside as the resting-places of enemy aircraft.

‘The flying services, both of the Army and the Navy, visited towns beyond the German border, that the German people should have vivid experience of the virtues and vices of air-raiding. There is evidence to show that these raids have not added to the happiness of the towns so honoured.’

On the subject of bombing submarines Major Whittaker says:

‘In home waters and in the Mediterranean successful war has been waged on submarines by seaplanes, and the Submarine Searcher type of airship. In fact were it not for aircraft, the submarine menace would be at least double what it is at the present time.

A 1917 Commentary on Bombing

‘With ceaseless energy aerial patrols scour the pathways of the Atlantic for the commerce destroyer both day and night. It is truly a dangerous work. Many a pilot and observer have been shown as “missing” in the casualty list who have had to alight on the sea through engine failure and have remained there without succour until death has brought the final peace of eternal rest.

‘The enemy, likewise, uses sea-going aircraft to the fullest degree. The units of the British Navy which penetrate to the guarded waters of the German coast bear witness to the existence and ubiquity of German seaplanes. Not less energetic are the Austrian seaplanes, which pervade the Adriatic that the approaches to their naval bases at Trieste, Pola and Cattaro, may be duly safeguarded.’

DEFENCE AGAINST BOMBERS

As we are discussing bombers in a general way, we may just find time and space for Major Whittaker’s comments on defence against bombers, remembering that he himself was on the Staff which organized London’s air defences and eventually stopped air-raiding. He says:

‘At home the aeroplanes engaged in aerial defence have, during 1917, continued their effective successes against the Zeppelins and against the invading aeroplanes. It must not be forgotten when dealing with the question of aerial defence how great a share of the burden is borne by the anti-aircraft gunners and the R.E. [Royal Engineers] personnel manning search-lights.

‘Their work, brilliant and consistent in efficiency though it may be, is never advertised by the daily Press. To the journalist all aviators are heroes of epic gallantry. The scientific excellence and the long endurance of the Army units in co-operation are forgotten because their exploits are not understood and there is less immediate risk to them in action.’

CHAPTER 4

The Coming of the Air Board



Here I may remark for historical reasons that as the result of agitation at the end of 1915 and the beginning of 1916, led by Lord Montagu of Beaulieu in the House of Lords and by Mr. Joynson-Hicks (later Lord Brentford), Mr. Pemberton-Billing, Colonel Walter Faber, and Colonel Bennett-Goldney in the House of Commons, a Government Committee of Inquiry was set up to examine during May 1916 the charge, first made by Colonel Faber, that pilots and their passengers in the flying services had been murdered by official negligence rather than killed by ordinary acts of war.

Although the Government Departments concerned were duly whitewashed, an Air Board was appointed to control the supply of aircraft for both Services, and to co-ordinate their work. This came into being on the 2nd of January 1917. Lord Cowdray, formerly Sir Weetman Pearson, was President. The other members were Commodore Godfrey Paine, R.N., who was also made Fifth Lord of the Admiralty, Lieut.-General Sir David Henderson, representing the War Office, Mr. William Weir (who was knighted in February 1917), as Controller of Aeronautical Supplies representing the Ministry of Munitions, and Mr. Percy Martin as Controller of Aero-Engines, also representing the Ministry of Munitions.

The Coming of the Air Board

BOMBERS OF 1917

By 1917, thanks very largely to the work of Sir William Weir, our aircraft output was going up, and with it the power of our motors. The Rolls-Royce Falcon in the Bristol Fighters was giving about 250 h.p. and the Rolls-Royce Eagle in the Handley Page bombers was giving 360. That looks small enough beside the 1,300 or 1,500 h.p. of the modern Merlin or the 2,300 h.p. of the Napier Sabre, but it was a lot of horses in those days. And those horses had to work for their living.

When you consider that the Handley Page O/400 had a span of 100 feet in the top plane and 70 feet in the lower plane, and that the ailerons were 20 feet long, and that the fuselage was almost 63 feet long, you can see that it was more than a little aeroplane. And for some reason, not connected with the Fleet Air Arm in those days, but simply, I think, with the housing question in such sheds as were available, it was made to fold its wings just like the Navy's ship-borne aeroplanes.

Also, at a time when all other aeroplanes carried their bombs unbecomingly exposed, slung along underneath the wings, the Handley Page had a proper bomb-chamber which was fitted with electrical apparatus for the dropping of eight 250-lb. bombs and eight 112-lb. bombs, about a ton and a quarter.

With all this it had a speed of 95 m.p.h. at ground level and tankage for 300 gallons of petrol, which was enough for eight hours' flying. All up the machine weighed about 12,000 lb.

I may add, just to give an idea of the size of the machine inside, that while one of the early products was being tested the firm's test-pilot, Mr. Clifford B. Prodger, took up twenty passengers in it. Which is the same as the number of parachute troops who are packed into a modern Junkers 52 troop-carrier.

In Germany during 1917 twin-engine bombers were considerably developed. The great A.E.G. Company, the Allgemeine Elektrizitäts Gesellschaft, made quite a good specimen, and so did the Albatros Company.

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Up to the beginning of 1917 practically all the bombing of this country which had not been done by the Gothas was done by Zeppelins. But our R.F.C.—and the R.N.A.S.—developed a habit of shooting down Zeppelins which made life in those craft unhealthy, so the Zeppelin Company itself took to making bomber-aeroplanes. It formed a company called the Flugzeugbau Friedrichshafen Gesellschaft m.b.H. Its bomber had a span of only 66 feet compared with the 100 feet of the Handley-Page and it was a smaller machine altogether, but like the Gotha it was a twin-engine pusher. It had two Benz engines of 226 h.p. each, and, like the Gotha, it had a gun in the nose, a gun on deck aft, and another under the belly.

Incidentally, one trick about the Gotha which was never used in any other machine, was that the gunner in the belly fired along a gun-tunnel—which is to say that although the sides of the fuselage from the tail forward to what one might call the breast of the machine followed an ordinary line, the true bottom of the machine was arched so that actually in the middle its depth near the wings was only the same as at the extreme end of the tail. That meant that the belly-gunner, besides being able to shoot practically vertically downwards could shoot horizontally along under the tail, and thus the actual field of fire of the belly-gun was much improved. And the fire came from it in such an unexpected way that even quite good pilots were caught by it.

Siemens-Schuckert, another great engineering firm, also made a big twin-engine bomber which seemed to be of A.E.G. design.

Towards the end of the war Dr. Junkers, who was primarily an electrical engineer in a big way of business, also took to building aeroplanes which contained ideas that were fifteen or twenty or more years in front of their time, but he did not get them going in time to be used in that war. His best work was done between wars.

Italy's great effort in 1917 was the Caproni Triplane, yet another two-tail type. It was originally developed as a biplane,

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but as a triplane it had three Isotta-Fraschini engines of something about 300 h.p. each, so that the machine had altogether something more than 1,000 h.p.

Whether it ever did any worth-while bombing I do not know. Probably not, because, although the Italians had some magnificent fighter-pilots, they had few who appreciated flying for long stretches over enemy country. Still, the thing did lift. One of the type, evidently emulating the Handley Page, took up thirty passengers, which it certainly ought to have done, as it had 1,000 h.p. against the Handley Page's 700 h.p. at the most. But the flight in which the Caproni Triplane most distinguished itself was when it took up fourteen journalists over Rome and then folded up its wings so that it killed the lot.

Late in 1917 the great Vickers Company, which had been making aeroplanes at Brooklands Motor Track since the year 1910, produced a twin-engine, long-range bomber, called the Vimy, which was standard equipment in the R.A.F. for about twenty years. It was too late for active service during the War 1914-18, but it distinguished itself immediately afterwards by being the vehicle which was used by Jack Alcock and Arthur Whitten-Brown when they made the first non-stop crossing of the Atlantic in 1919. It was also used by the brothers Ross and Keith Smith in the first flight from England to Australia. And one of them took Major Helperus van Ryneveld and Captain Quintin Brand most of the way from London to Cape Town on the first flight to South Africa. All six pilots were knighted for their pioneer performances.

The French produced some interesting and some amusing bombers during 1917 and 1918 which one might discuss at length if this were purely a technical history of the development of bombers, but unfortunately there is no room for them.

Most of the French bombing was done with bombs slung underneath the wings and fuselages of ordinary single-motor biplanes. And anyhow French bombing never amounted to much.

CHAPTER 5

Bombing in 1918



Although by the beginning of 1918 bombing had become a menace in this country, at any rate in the south-eastern corner of it, apart from bombing which was done in the north and Midlands by Zeppelins, British and French bombing was confined necessarily to purely military objectives in France and Belgium. And as this bombing was all being done in the countries of two of the Allies, particular care was taken to see that the bombs were kept strictly to military objectives.

The Royal Naval Air Service at Dunkerque were the only people who had the Handley Page twin-motor bombers, and consequently they alone could carry heavy bombs. Even they were not allowed to do the best they could have done, because when they wanted to drop heavy bombs on the lock gates at Zeebrugge, in the hope of emptying the Zeebrugge-Bruges Canal and laying up all the German submarines which used it for a hiding place, besides, naturally, blocking the exit with wreckage, the Officer Commanding R.N.A.S. at Dunkerque was forbidden to do so by the Admiral Commanding Dover Patrol, because the lock gates were to be smashed by heavy shells from the Navy's monitors, shallow-draft, low-freeboard craft which carried one very big gun and were intended for coastal bombardment.

Unfortunately the Germans set up the Tirpitz Battery near Zeebrugge with guns which outranged the monitors, so that they could never get within reach of the lock gates.

Bombing in 1918

But the bombers from Dunkerque tried gallantly to smash the harbours of Ostende and Zeebrugge, the kind of thing that the R.A.F. has been doing in this war to all the harbours along the coasts from the Arctic Circle to Spain.

The bombers used by the Army, which meant the Royal Flying Corps, were chiefly turned on to break railway lines and to bomb ammunition dumps. And the way those slow old machines used to go off at night without blind-flying instruments, and land in early morning fog without radio-beams to bring them back, and, remember, without parachutes, or bullet-proof tanks, or slots or flaps, was amazing at the time. It must seem far more amazing to the air-crews of to-day whose machines are equipped with all those aids to the prolongation of life.

I used to be much interested then in the points of view of pilots who were on the different jobs. One, who later became a useful member of the British Broadcasting Corporation and is now back in the R.A.F., remarked that night bombing was quite the most pleasant job in the war because one could generally dodge the searchlights and the Archie guns and one could not be seen from the ground, and there were no fighters to worry one. In fact he could not understand how the day bombers and reconnaissance machines and fighters carried on when there were so many things to make the sky dangerous in daylight. He admitted that a single-engine pusher biplane, with the engine just at the back of one's neck, was not the safest aeroplane in the world, but he argued, as consolation, that if you did hit anything on the ground when landing in fog or in the dark you were thrown clear of the machine, which generally turned a somersault over the top of you, whereas in a tractor you generally fell with the fuselage and were crushed by it.

A gallant Norwegian pilot, who later commanded a squadron, one Major Trygve Gran, came back from a night raid in an F.E.2b pusher biplane with a water-cooled Beardmore engine, the radiator of which had been hit by a rifle-bullet about

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thirty miles from home. The water had all run out, the oil boiled, and all the bearings went, but somehow it kept on running, and lubricated itself somehow with the boiling oil. He came in with the engine making a clatter like a threshing-machine, and remarked that he had no idea that molten white metal was such a good lubricant.

Daylight bombing, even in what we considered fast machines in those days—some did nearly 100 m.p.h.—certainly was not pleasant. And when people were sent out with instructions that a certain railway junction must be destroyed, they naturally did not care about coming too low. At one time strenuous efforts were being made to smash the railway junction at Cambrai. There was one man in a squadron who, although he was a good pilot and no mean fighting man, had a rooted objection to coming down low to drop his bombs. But this time the squadron-commander, who was resolved to get the job done, gave this chap definite instructions.

When the squadron came back he asked this pilot whether he really had come down low this time. The pilot answered, 'Well, sir, I didn't exactly count the penny-in-the-slot machines on the platform, but I know that my wings were level with the roof.'

THE INDEPENDENT AIR FORCE

During the winter of 1917-18 London, in particular, had had such a hammering from Gothas and Zeppelins alike that there was an outcry for reprisals—the man in the street usually called it 'reprizzles'. But there was nothing much with which to reprise. As I have already said, late in 1916 and early in 1917 Captain Elder, R.N., was stationed with a small force of the R.N.A.S. at Luxeuil, near Nancy, to bomb the Rhineland armament works. But he and his force were recalled after a few months.

At the end of 1917 Major-General Sir Hugh Trenchard had handed over the command of the R.F.C. in France to Major-

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General John Salmond and had come to London to be the first Chief of the Air Staff of the new Royal Air Force which was to come into being on the 1st of April 1918. Lord Rothermere had been appointed Air Minister, when everybody expected Lord Cowdray, who had been President of the Air Board, to be made Secretary of State for Air.

The Royal Air Force as such, formed by combining the R.N.A.S. and the R.F.C. came into being officially on the 1st of April 1918. On the 14th of April (a Sunday) people were astonished to hear officially that General Trenchard had resigned from his job as Chief of the Air Staff. On the 15th of April Major-General Frederick H. Sykes, who had been the first officer to command the Military Wing of the R.F.C., was appointed C.A.S. instead.

In the House of Commons Major J. H. Baird (later Lord Stonehaven, since deceased), Under-Secretary for Air, stated that General Trenchard 'took a view as to the powers and duties of the Chief of the Air Staff which the Secretary of State of the Royal Air Force could not accept'. After that there was a first-class row in the House of Commons and in the Press and on the 25th of April Lord Rothermere resigned his post, as Secretary of State, and on the 29th Sir William Weir, now Lord Weir of Eastwood, was appointed in his place.

Sir Hugh Trenchard refused to oust his former friend and colleague, General Sykes, from his post as Chief of the Air Staff, and a month later the announcement was made by Mr. Bonar Law in the House of Commons that General Trenchard had accepted the command of a very important part of the British Air Force in France.

This was officially called the Independent Force, R.A.F., and it was intended solely for offensive action against munition works and military objectives in Germany. It was not intended to co-operate with the Army, except under limited conditions duly laid down.

Thus it was the first bombing force to be organized for that

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purpose. The R.A.F. in France under General Salmond was still directly under command of the Commander-in-Chief of the Army, Sir Douglas Haig.

The occasion was historic because it marked not only the first recognition of an independent bombing force which could operate free from any orders of the Army or the Navy, but it marked the birth of the force on which the Royal Air Force was built.

Its bombers would seem inconsiderable to-day, for few of them could carry more than 1,000 lb. of disposable, or useful, load. And that had to include the weight of a crew of two and their machine-guns and ammunition and the fuel for the proposed voyage, before one started calculating what weight of bombs it could carry.

Nevertheless, those comparatively light bombers did a great deal of damage in the Rhineland towns, which then, as now supplied so much of Germany's munitions. Karlsruhe, Mannheim, Frankfurt, Düsseldorf, and other towns were fairly consistently hammered.

Rather late in 1918 General Trenchard got a squadron of twin-engine Handley Pages, the only squadron that was used apart from the R.N.A.S. And that began to show the Germans that we could produce an answer to the Gotha.

BOMBING ESSEN

The great ambition of Sir Hugh Trenchard's pilots was to bomb Essen—where the great Krupp armament works were. I believe that only one machine ever got there, and that was a Handley Page piloted by Lieutenant 'Gus' Digby. I do not think that he had much weight of bombs, because all the petrol he could carry was needed to get there and back. But he certainly did drop bombs in Essen.

There was much amusement about that flight. The day before he was to start his aft gunner was taken ill. There was a rush by

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the rest of the flight to volunteer for his place. And as there was no particular reason why one man more than another should have the coveted place, Digby settled the argument by choosing as his aft gunner an air-mechanic who was not an air-gunner at all. His claim to fame was that he had once played full-back for Aston Villa. And everybody accepted the decision as a judgement of Solomon.

Mr. Digby in later years acquired a high reputation as an airline pilot, first of all in Western Australia and then in this country. He was flying when war was declared and is, I hope, flying still.

HISTORY REPEATS ITSELF

Quite near the end of the war an affair happened which illustrated the unwisdom of putting air bombing in the hands of Army officers who do not know how to use it. While the Germans were retreating as fast as they could, the Staff of a certain Army Command discovered that if a certain bridge could be smashed a large number of German troops would be cut off by the river and would have to surrender. So orders were sent to the appropriate R.A.F. Commanding Officer that the bridge was to be smashed at all costs.

Two or three aeroplanes were sent at it and failed. The Army insisted that the job must be done, and more aeroplanes were sent in rapid succession.

The Germans soon spotted what our move was intended to do, so they planted howitzers on the far side of the river. Using 'Fuse 0', which exploded the shells almost as soon as they left the gun muzzle, they just blasted the aeroplanes out of the sky as they appeared. The legend in the R.A.F. was that something like three squadrons were wasted in that way.

The incident resembles the attempts to bomb the bridge at Maastricht when the Germans broke through the French and Belgian Armies in 1940. Of all the machines that were sent against the bridge only one man came back unwounded. The

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others were either dead or prisoners in Germany. But there was this big difference between the two affairs: in 1940 the R.A.F. were making a desperate effort to stop a German advance on an army which was already beaten. In 1918 the R.A.F., in much greater numbers, tried to stop the Germans from retreating when they were already well beaten. The only result of stopping them would have been that some Division or Corps Commander would have had the credit of capturing so many more German prisoners than his next door neighbour. Such sacrifice might be justifiable if the retreating army were likely to turn and fight again, but at that time the Germans were past turning. That was the last serious bombing episode in the War 1914-18.

THE HANDLEY PAGE FOUR-MOTOR BOMBER

Naturally there was much bombing in the Side-Shows, as the confirmed West-Fronters used to call the wars in the Balkans and Arabia and Africa. Of that I will say more later. But here is the proper place to record, as one of the technical tragedies of the war, the fact that the giant four-motor Handley Page bomber was never used on active service.

This machine was certainly one of the finest engineering achievements of the war. It was known as the V/1500. V in those days had no special significance, and no mystic reference either to victory or a German symphony; it was just an aircraft manufacturer's serial number.

The idea was that numbers of these machines should start from coastal aerodromes, particularly from that at Bircham Newton, to bomb Berlin.

The V/1500 had a span of 120 feet and a gap between the planes of 16 feet at the centre section, which tapered to 12 feet at the wing-tips. Its overall length was 62 feet, its maximum height was 23 feet, the chord of the wings was 12 feet, and the total wing surface was 3,000 square feet. At the biggest cross-section the fuselage was 8 feet deep and 6 feet 2 inches wide.

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It had four Rolls-Royce Eagle VIII engines of 360 h.p. each, and 1,440 h.p. was a lot of power in those days. But keeping 48 cylinders with 96 valves and 192 sparking-plugs in order was a full-time job for several mechanics. The engines were arranged two in tandem on each side of the fuselage, mid-way between the upper and lower planes where they were well out in the air. In front of the front engines was a huge radiator, which was supposed to keep them both cool.

An interesting technical point is that the tractor screws had a diameter of 12 feet 5 inches and the pusher screws a diameter of only 10 feet 4 inches. The machine weighed 15,000 lb. empty and 30,000 lb. full, which was a remarkably good ratio of tare-weight to full load.

The disposable load apart from fuel was 7,000 lb., and I see that the tank capacity was 1,000 gallons, which would account for the other 8,000 lb. The speed low down was 103 m.p.h. fully loaded, and at 10,000 feet 95 m.p.h., so it would have taken all of nine hours to get to Berlin and back. Nevertheless it was a very fine aeroplane for its time.

So far as I can discover only one of its type was ever used on active service, and that was in very curious circumstances. In 1920 we somehow fell into a war with the Kingdom of Afghanistan. The King apparently thought that the British Empire had been so damaged by the Great War, of which he had read much, and that the Indian Army had been so depleted by the ghastly mistakes in which it was concerned in Mesopotamia, now called 'Iraq, that he could comfortably take on the Indian Empire.

Anyhow he tried. One of our crack cavalry regiments took a nasty knock and lost nearly all its officers through a too-ridiculous tactical error in a mistaken charge, and, I assume, the R.A.F. thought that something ought to be done to uphold our reputation. Consequently a V/1500 Handley Page was sent out to India.

The pilots were Squadron-Leader 'Jock' Halley, who was, I think, the shortest pilot at that time in the R.A.F. (naturally

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the High Authorities *would* choose him to pilot the world's biggest aeroplane) and Squadron-Leader A. C. S. McLaren. They went by Italy, Mesopotamia, and Persia. Squadron-Leader Halley flew the machine up to Peshawar. Thence he bombed the City of Kabul, capital of Afghanistan. What military damage his bombing did was never made known, but a fairly reliable account said that one bomb removed a wall from the King's Harem. (This appears to have been the beginning of female emancipation in Afghanistan, a policy which brought interminable trouble on King Amanullah when he tried to establish it as a principle.)

Although the V/1500 was never used in first-class war it remained in service for several years, and its huge size much impressed the vast crowds which went to R.A.F. Displays at Hendon. I remember Wing-Commander Sholto Douglas (now Air-Marshal Sir Sholto) leading a formation of them in a terrifying take-off with about ten feet to spare over the heads of the front row of the crowd.

The V/1500 was the first aeroplane on record, at any rate the first aeroplane to fly, which had a gun-position right in the tail. It had a very big biplane tail with four rudders, two on each side of the end of the fuselage. And the gunner had an excellent position right in the extreme end of the fuselage.

One of the first of the type caught fire after a crash near the Handley Page factory at Cricklewood. The sole survivor was an Air Ministry official who was in the tail of the machine, and was thrown out. Another flew into a shed at Andover and killed its crew.

Another of these machines was sent to Newfoundland with the intention of having it fly the Atlantic. The first pilot was Major Brackley, D.S.O., D.S.C., who was later Superintendent of Flying with Imperial Airways Ltd., and is now serving with the Coastal Command Staff, R.A.F. The second pilot was Major Trygve Gran, already mentioned. And Admiral Mark Kerr was in charge of the expedition.

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Fortunately for them Alcock and Brown flew the Atlantic in a Vickers Vimy before they had started. So Admiral Kerr decided to fly non-stop from Newfoundland to New York, by way of a good-will flight, as we should now call it. While over the forests of Nova Scotia one of the leading airscrews broke and wrecked the engine. Bits of the engine came out and broke the airscrew of the aft engine. That left the machine with two engines going on one side. Major Brackley held it in the air till he found a clear spot, and then wisely put it down, and with such skill that the whole crew survived.

CHAPTER 6

Side-Show Bombing



To go back now to the side-shows. The R.N.A.S. as usual did fantastic bombing with the crudest aircraft. Flying from the island of Mudros, which the R.N.A.S. made its Headquarters near the Dardanelles, R.N.A.S. pilots used to try to bomb the Turks, but that did little good. Nevertheless one of them has the credit of torpedoing the only warship that was sunk by that weapon from the air. Flt.-Lieut. Edmunds (now Air-Commodore) flew a Short float-plane over the Gallipoli Peninsula and released a torpedo at a transport lying off Maidos. The ship began to sink, but it had only about seven feet of water under it, so it sat on the mud without being much the worse.

On another occasion the German warship *Goeben*, which had fled from the British Fleet, on the outbreak of war, through the Dardanelles to Constantinople, ventured out but ran aground at the entrance of the Straits. Several attempts were made to bomb the ship without success. One brave R.N.A.S. officer tied the war-head of a torpedo underneath his seaplane and tried to drop it on the deck of the *Goeben*. He lifted the ship with the concussion of a near-hit on the rocks close by. But next morning the *Goeben* had gone back to Constantinople.

Side-Show Bombing

BLOCKADING THE BULGARS

In this corner of the war one of the quaintest bombing episodes happened. Flt.-Lieut. Gaskell-Blackburn was flying a sea-plane along the top of some cliffs on the Bulgarian coast trying to drop bombs into a Bulgar camp. After dropping a bomb he looked back to see what had happened. To his surprise he saw another burst close to the smoke of his own bomb.

He could see nothing in the sky, so when he came round again and dropped a second bomb he watched for the result, and again he saw the second burst. Then he looked over the side of the cliff and saw, close to the shore, an ordinary English trawler such as had been brought out to the Mediterranean for patrol work and mine-sweeping. It was sitting there with its one gun at extreme elevation, so he estimated that it must have been lobbing shell after shell over the edge of the cliff.

He took the number of the boat and that evening when he returned to Mudros he went down to the harbour and found that the boat was in. The mate was in charge, so he asked what happened. The mate said they saw him flying over the top of the cliff and saw the bursts of his bombs, but could not see what he was dropping at. Still, they reckoned that he knew what he was doing, so they thought they might help if they lobbed a few shells over the edge of the cliff near the smoke of his bombs. When Blackburn asked where the skipper was, the mate explained that something had gone wrong with their engine and he had been ordered back to Mudros to have it put right, and, he added, 'the skipper's in the dinghy a-blockadin' the Bulgars'. And sure enough the old man was sitting there, with a deck-hand at the oars, carrying on with the blockade with a rifle across his knees.

Another fine effort of the R.N.A.S. won a V.C. for one of the pilots. Squadron-Commander Richard Bell Davis and Flt.-Lieut. Smiley started off to bomb a railway junction in Bulgaria. On the way back Smiley's engine failed and he landed in

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Bulgaria. Bell Davis landed alongside, took Smiley into his machine somehow, and took off just as a bunch of Bulgarian cavalry rushed them. Bell Davis got the V.C. He was in 1941 Vice-Admiral R. Bell Davis, V.C., D.S.O., A.F.C., in charge of all flying training of the Naval Air Service. He left the R.A.F. shortly after the war and returned to the Navy, but he returned to aviation when the Navy took over the Fleet Air Arm from the R.A.F. and formed the Naval Air Service again.

One joyous bombing affair happened in connection with that same bridge. Lieut.-Colonel George Dawes, commanding R.F.C. at Salonika, persuaded Captain 'Dan' Scarlett, R.N., to co-operate in forming a composite bombing squadron of R.N.A.S. and R.F.C. to attack it. They assembled at an R.F.C. aerodrome and set off. Half-way they were intercepted by a German 'circus' of fighters. Colonel Dawes had taken Captain Scarlett in his own B.E.2c without guns or firearms, just to watch the fun. But, in no way intimidated, the Colonel boldly attacked German after German aeroplane, and the Germans fled—scared, so local R.N.A.S. report said, by Captain Scarlett's fierce face.

The raid proceeded and succeeded. And on returning, Colonel Dawes, who did not profess to be much of a pilot, crashed his guest on his own aerodrome. Fortunately nobody was hurt. And, to use a modern phrase, a good time was had by all.

Constantinople, often known in previous centuries as Stamboul, and now called officially Istanbul, by request of the Turkish Dictator, the late Mustafa Kemal, officially Kemal Atatürk, was only bombed once. Major Savory, R.A.F. (formerly Squadron-Commander, R.N.) flew a Handley Page O/400 out to Mudros and theoretically bombed the Sublime Porte, but apparently Yildiz Kiosk escaped damage.

About the most fantastic bombing that the R.N.A.S. did was the continual effort to bomb the Hejaz railway, which ran down the back of Palestine from Syria to Medina. The railway was built by the Turks so that they could control the Hejaz and

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central Arabia, and down that railway the Turks carried the troops which attacked the Suez Canal and later held Palestine and the country farther south. That was the line which Colonel T. E. Lawrence was always trying to blow up.

¶ The R.N.A.S. sent out the little old Isle of Man packet-boat *Ben-my-Chree*, with half a dozen folding-wing Short float-planes, each with one Sunbeam engine of 220 h.p. It was commanded by Wing-Commander Cecil L'Estrange Malone, R.N.

In the hot air and in their generally soggy condition the machines could only stagger off the water with full load, and could not get over the top of the hills. The Turks used to sit on the hill-tops and shoot down at them as they crept up the valleys. When they had got rid of their bombs they could lift clear of the hills, and fortunately the Turks had no anti-aircraft guns, up there.

¶ By the time they got back most of the valves in the engine had gone crooked, but they used to keep running so long as the valves were red hot. If they stopped nothing would induce them to start again, because the valves warped out of shape in cooling. The workshop in the ship was so organized that as soon as a seaplane was hauled aboard the engine was taken out, a new one was put in, and the machine was ready for use next day. While the pilot was away the engine was taken to pieces and new valves were fitted, so that it was fit to go into service again.

You will perceive that this was magnificent, but it was in no sense regular bombing, although in a sense it was regular enough.

One of the pilots on this job who did many such perilous trips was Flt.-Lieut. Maurice Wright, who is now Deputy Managing- Director of the great Fairey Aviation Company Ltd.

Later on the famous Commander C. R. Samson, D.S.O., took over the ship from Malone and continued operation until, unfortunately, he tied her up in Castelorizo Harbour near the Turkish mainland, and the Turks man-handled a bat-

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tery of guns up to the top of the hills overlooking the harbour and sank her where she lay.

THE R.A.F. IN PALESTINE

The campaign in Palestine was carried on in accord with the best traditions of the British Services. General Maxwell with inadequate forces on the land and with an Air Force which consisted of a few squadrons of B.E.2c's got as far as winning the first battle of Gaza, and there he stuck. Thereafter General Maxwell was shelved, and General Allenby was sent out with practically unlimited men and material, and the makings of a real Air Force under Major-General Geoffrey Salmond, brother of John Salmond, who was commanding in France. He had Handley Pages and D.H.9's and all the latest weapons. Then a real air war began which ended with one of the biggest bombing operations of the war.

The Australian Cavalry and a lot of our home-grown yeomanry made a dash up the coast of Palestine, riding most of the time on the sand, until they got level with the rear of the Turkish Army. Then they cut inland. While they were doing so the R.F.C. bombed the Turkish wireless stations all the time, to prevent information of our movements from reaching H.Q.

The Turks, who were being hammered by Allenby in front and had already lost Jerusalem, at last heard of the cavalry interception and began to retreat. The bulk of the army was caught in a pass through the Hills of Judaea and was bombed to pieces by the R.A.F. Pilots who were there told me that one could not go wrong. If one missed the road one could not help hitting the hill-side, and if one hit the hill-side one just blew chunks of it out on top of the unfortunate Turks in the pass. The Turkish transport became jammed and the army jammed with it. Some of the men escaped bombing by climbing the hills, and there many of them were massacred by the local Canaanites. But the road was a mass of guns, trucks, the cars

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and carriages of the harems of the Turkish senior officers, pack animals, mule-carts, and men.

After the remnants of the army had got away towards Damascus, only to be cut to pieces there by the Emir Feisal's Arabs, who had been fighting under Lawrence, a British Staff officer rode up the pass to see the result. When he came back to Headquarters he went to see Geoffrey Salmond and said, 'Your men are not soldiers, Salmond, they're butchers.'

Unpleasant as the remark sounded, it was perhaps the truest appraisal of bombing when properly done that has been uttered.

And that, I think, may be taken as the end of the section concerned with bombing during the War 1914-18.

Actually the first people to finish their own particular war were the Army of Salonika. They also did a good deal of bombing, especially when the Bulgars started to retreat, after they had been bombed out of Mount Doiran. The R.A.F. and the French *Service d'Aviation* chased them up the defiles to places where, after a man had gone down to machine-gun the Bulgars on the road, he had to climb for a couple of miles to get out of the defile so that he could turn round and go back for more ammunition. The bombers at any rate could operate from the top of the defiles.

The campaign in Mesopotamia was won as soon as the army in Palestine broke. And the R.A.F. there, under Lieut.-Colonel John Tennant, who was killed in an accident in Scotland in August 1941, helped a lot in the last big attack.

The final collapse of the German Army in France did not come until some weeks afterwards. But certainly the bombing of the Turkish Army was the biggest bomb affair in the war.

THE BALLOON BARRAGE OF 1918

I have said nothing about the Zeppelin bombing and results which they achieved in England, because we are concerned in

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this discourse with aeroplane bombing as such. Naturally the bombing by Gothas, day or night, was very small business compared with the bombing which we have suffered in this war. And yet it seemed bad enough at the time.

The London Air Defence Area, commonly known as L.A.D.A., was organized late in 1917 by Major-General E. B. Ashmore, D.S.O., R.A., who had commanded a brigade of the R.F.C. with distinction in France, and later had commanded a brigade of the Royal Artillery. He originated, although he did not claim to have invented, the mechanism of the balloon barrage of which we see and hear so much to-day. He also created and organized the Observer Corps, which keeps track, with its listening apparatus of the approach and direction of enemy aircraft, and keeps the Fighter Command in touch with such movements. He had been appointed to the D.S.O. in France, but he never got even the O.B.E. for stopping the bombing of London, which was one of the best pieces of work in the war.

General Ashmore's balloon barrage consisted of two balloon aprons, one in Epping Forest and one at Shooter's Hill near Blackheath. Four or five balloons were stationed about a quarter of a mile apart. They were connected by cables and from those cables at intervals of sixty feet hung piano wires, each 300 feet long, with a plumb-bob at the end. So there was a sort of apron or curtain 300 feet deep and something over a mile long which stretched across country with its top at about 8,000 feet.

There were only two of them, but by exhorting everybody to keep their existence a secret, their number and extent and height were multiplied to such an extent that their mere existence intimidated the Germans. Consequently General Ashmore accomplished what he set out to do, namely to keep the German bombers above 8,000 feet. What he feared was that they would come down low and machine-gun the houses, as some bombers have done in this war.

Anyhow, the balloon aprons kept the bombers above 8,000

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feet, the gun barrage extended to 14,000 feet, and above that were the fighter aeroplanes.

As I have said, we had no blind-flying instruments in those days. There was no radio to bring people home in bad weather, there were no parachutes to save a man if his machine were set alight or badly shot up. But those night-flying fighters did their jobs just the same. They were much helped by the searchlights, which were very good indeed.

The L.A.D.A. Command used to send up their best pilots now and then to be caught by the searchlights and to see whether they could get away. But the searchlights held them whatever they did or wherever they went.

When there was a raid on, a habit of our night-flying pilots was to wait till they saw a lot of shells bursting at one particular quarter of the sky, which indicated to them that there was a German machine somewhere about, and then they used to dive into the shell-bursts, hoping to find a bomber there. And it worked.

One big daylight raid over the City of London, which was led by Major Brandenburg, later an important official in German civil aviation, did a lot of harm around Liverpool Street Station, but they lost a lot of men and machines on their way in and out. And air-raiding both by Zeppelins and aeroplanes stopped about the end of March 1918. There was no more bombing in England for more than twenty-two years.

PART 2

Bombers between Wars

*As when, to warn proud cities, war appears
Waged in the troubled sky, and armies rush
To battle in the clouds.*

‘Paradise Lost.’

CHAPTER 7

Colonial Warfare



Now let us take a look at the development of bombers between wars. For a long time such bombing as was done was directed against people who were making themselves unpleasant on the ground. The French, with that intellectual honesty and freedom from hypocrisy which is their chief charm, called it colonial bombing. In fact they evolved a type of bomber which was officially called the '*Type Coloniale*'.

It had the usual two engines, the usual bomb-racks inside the machine, a gun-pit in front with guns pointing downwards, and a gun position aft and below which was so arranged that the gunner sat on a kind of balcony, not unlike a very small edition of the stern-gallery of an old-fashioned warship, with the fuselage of the machine extending over it as a sort of canopy, so that he could sit in the shade, with plenty of traverse for his gun, and shoot at the indigenes in comfort.

In this way any odd Syrians and Moroccans and Senegalese and Gaboonese and French Equatorial Africans and Indo-Chinese who happened to object to French rule were kept in order.

Even in the benign British Empire we have had to do a certain amount of bombing. For the better part of a century we have been continually at war on the North-West Frontier of India, or to be more accurate, of the Punjab, as the Punjabi

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does not admit that he is an Indian, and asserts that India only begins east of the Indus.

If the Pathan tribes insist on regarding warfare much as we regard football, that is no fault of ours. And as the custodians of the Indian Empire we have to prevent them from carrying their national sport into the fertile valley of the Ganges, and from helping themselves to the riches of India.

Many lives have been wasted and much money spent on futile punitive expeditions into the hills, where small numbers of Pathans have sat behind rocks and potted our troops at their leisure, varying the sport by wild rushes in which swords and the Afghan knife have been matched against revolvers and bayonets. We have kept the Pathans out of India, but we have spent many more lives in doing so than we have taken of theirs. Only since Air Power developed after 1918 have we been able to keep the Frontier quiet at a reasonable cost.

Our technique, evolved by Air Chief Marshal Sir Hugh Trenchard (now Viscount Trenchard), while he was Chief of the Air Staff between 1918 and 1930, has been to find out which was the aggressor tribe and to tell them by envoys, or by leaflets from the air, that if they did not stop raiding our peaceful coloured fellow subjects and brethren the Air Force would have to go and knock spots off them.

At first the Pathans paid little attention, but gradually they learned that the Air Force meant what it said. The R.A.F. always gave fair warning which village they were going to bomb and told them that if any of the women and children got hurt the fault would be theirs for keeping them in the village. The result was that at first they kept them there and the women and children did get hurt. Then they retired to caves and watched their villages being bombed.

That annoyed them for several reasons. One was that in the caves they were devoured by fleas. Not that the Pathan minds dirt. There is an old Army story that a soldier who had been told off to wash a Pathan prisoner before bringing him to the

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Intelligence Officer for examination came in and said, 'Please, sir, what are we to do with this 'ere Pathan? We've been washing him half an hour and we've just come to another suit of clothes.' But they did not like being eaten alive, so they had to choose between coming out and being bombed, or coming out and promising to behave.

One tactic of the R.A.F. which was very effective was bombing their reservoirs instead of bombing the villages. Every Pathan village lives on the irrigation of the hillside. The food is grown on terraces, which are watered by the skies during the rains and from the communal tank during the dry season. When a reservoir is bombed it bursts and washes all the soil off the terraces and there is no more food for that village for that season. And that, I believe, has done more than anything else to produce the peace which has existed on the North-West Frontier for several years past.

One Pathan tribe, after being treated in this way, sent down a protest that it was not sportsmanlike and said that if we went on doing it they would not have any more wars with us. Quite seriously they regarded their annual war with our Punjab Frontier Force very much as we regard the football season.

We also used delay-action bombs, thinking that they might inspire the Pathans with more respect for us. But there is a story that, in the exact sense, we got our own back, or rather they handed it back to us. One of these delay-action bombs, a big one, fell in tribal territory. During the night a gang of the tribe carried the bomb across country for ten miles or so into our territory, and planted it under a railway-bridge, where it duly went off in the morning.

Unfortunately they tried the trick another time, but took the bomb home to their village, presumably to have a meal before starting across country, and it went off early and blew a house to pieces. And of course it killed women and children.

Readers will probably remember Lord Trenchard's remark in the House of Lords a year or two ago, about the peculiar

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affinity which bombs have for women and children. He said that one might almost think that women and children were fitted with special magnets to attract bombs. But readers may also have noticed that since the women of all nations have been called up to work in armament factories we have heard very little in the press about the bombing of civilians in general, and women and children in particular.

At last people seem to agree with the principle, the preaching of which made me very unpopular in the last war, that if people in uniform are to be killed, surely the people who supply the munitions of war, and so keep the war going, are equally justifiable targets for bomb or shell. And if that be so, then the people who make material to make the munitions, and the people who grow the food to feed the people who make the munitions, and the people who pay the taxes to pay the people who make the munitions, are all equally justifiable targets. And, on the other hand, anybody who is not doing his or her best to help to win the war ought to be shot anyway.

One of our Bristol Fighter bomber squadrons discovered a useful trick during one of our numerous campaigns against the Wazirs. Their aerodrome was a baked-up valley bounded on the west by a scarp which was a sheer cliff. The wind blew constantly from the east right against the face of the cliff. The machines had to taxi out to the foot of the cliff, take off over the blistering ground, where all the lift had been stewed out of the air, and then circle slowly till they could clear the escarpment, by which time they had barely enough petrol left to get across Waziristan and back.

One day a pilot in circling for height flew down wind very close to the cliff, and suddenly got a lift which shot him up several hundreds of feet. Next time round he tried it again and was shot up nearly to the top of the cliff.

After that the pilots used to take off, circle round to the cliff, turn their tails as close to the cliff-face as they dared, throttle their motors to bare flying speed, and just go up on the lift. At

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the top they would open their throttles, circle round, and go off to bomb the Wazirs with half an hour's petrol to spare.

Any youngster who has ever flown a glider could have told them all about that up-current at a sight of the cliff. But few people knew anything about soaring flight in those days—and I doubt whether many Air Force pilots, of any nation, do to-day.

CHAPTER 8

Control without Occupation



Besides our chronic trouble on the North-West Frontier we had for several years a state of acute disturbance in Arabia. The desert tribes of 'Iraq did not like being governed from Baghdad and were continually in revolt against King Feisal, whom we had made King as compensation for not giving him the throne of Damascus and making him King of all Arabia, as promised by some of our politicians to Lieut.-Colonel Lawrence.

In the first place he was a Hejaz Arab and belonged to one sect of Mahometans (Shaiah or Sunni) and most of the tribes belonged to the other sect (Sunni or Shaiah). It was rather like the old trouble in this country when Queen Mary, the Roman Catholic, was Queen of England. But we had put Feisal on the throne and we had to keep him there.

Then there was the continual trouble of the desert Arabs raiding the peaceful cultivators along the River Tigris, an industry which has flourished ever since Cain raided Abel. Also the Wahabi Akhwan, or Puritan Brotherhood, of King Ibn Saud, raided any 'Iraqi or Trans-Jordan tribe they could catch. And on top of that the Kurds up in the hills to the east and north of Baghdad raided anybody on general principles. Thousands of infantry, with some armoured cars and cavalry and a few aeroplanes had the job of dealing with all these disturbers of traffic.

But when Sir Samuel Hoare, as Secretary of State for Air, with Air Chief Marshal Sir Hugh Trenchard as Chief of the

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Air Staff, took charge in 1922, things began to move. The Army which had been costing many millions a year was taken out of 'Iraq—British and Indian battalions as well. Air-Marshal Sir John Salmond was sent to command the R.A.F. in 'Iraq, and, for the first time in history, an Air Officer was made Commander-in-Chief of all His Majesty's Forces in a foreign country.

He had two or three battalions of white troops at Baghdad and Basra, just in case of emergency. But he relied for aerodrome guards on the airmen themselves and on native Levies. Some of these were 'Iraqis, but the best of them were Assyrians—Christian hillmen from up in the north. They are a different breed from any of the people round them. They are neither Turks, Kurds, nor Arabs, and they are splendid fighting men. All these levies had British officers. Many of those who worked with them would like to know what has happened to their little Assyrians since we cleared out of 'Iraq and left them at the mercy of the Baghdadi politicians, who hated them.

We sent practically no troops into the desert or into the hills, and the tribes were kept in order by the R.A.F. alone. This was what Sir Samuel Hoare called 'Control without Occupation', and thus gave a title to a new political system. It is a principle which may—I say it with reserve—be used in the future to assure the peace of the world.

I recommend my readers to lay hands on two stories by Rudyard Kipling, the first is 'With the Night Mail', and the other is 'As Easy as A.B.C.' The A.B.C. is the Aerial Board of Control which rules the world by common consent. They are two of the grandest stories in English literature. They give one an idea of what civilization may be like a hundred or so years hence, when bombing has done its work, and humanity is content to be policed by an International Air Force which works under the orders of the A.B.C., and is equipped with real aircraft, not merely with gasoline kites. Incidentally, Mr. Michael Arlen adopted the same basic idea in his entertaining book *Man's Mortality*.

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OPERATIONS IN 'IRAQ

Comparatively little bombing was needed to teach the desert tribes to behave. The Kurds up among the hills in their strongholds were tougher stuff. Both Kurds and Arabs, like the Pathans, regarded war partly as a species of national sport, but it is more of an industry for them than it is for the Pathans.

We used mostly light bombers, the old Bristol Fighter and the D.H.9A, commonly called the Nine-Ack, and a few Vickers Vimys. Then the Westland Wapiti succeeded the Brisfit and the Nine-Ack. The Vickers Vernon succeeded the Vimy, but it was designed to be a troop-carrier. Sometimes when the R.A.F. had bombed a tribe a troop-carrier was sent out with perhaps a dozen men and a machine-gun, as escort for a political officer who went to interview the Sheikh and impress on him that he must behave himself.

Of course there was no opposition to our bombers, which incidentally carried guns fore-and-aft and acted as ground-strafters as well as doing their bombing. But in those days motors were not so reliable as they are now and our people had many adventures. Sir John Salmond himself had quite a narrow escape during one of the many operations against Sheikh Mahmoud, who was the Kurdish leader.

Contrary to all the laws that a Commander-in-Chief should never risk his life in the firing-line, Sir John had gone out in a Nine-Ack with another pilot to watch the bombing of old Mahmoud's stronghold. One of the other Nine-Acks had engine trouble and the pilot landed in the only available flat place, close to the stronghold, where they would certainly have been captured if they had been left.

Sir John told his pilot to go down and land alongside the other machine and signalled to another Nine-Ack to come down with them. So the two machines landed, the other took the pilot of the grounded machine on the machine-gunner's lap, and Sir John took the gunner on his. And the two machines

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got off safely, with three up apiece. There can be few airmen-gunners who can say that they have sat on an Air-Marshall.

Another of our Nine-Acks made a forced landing in the desert and was at once attacked by the horsemen of the tribe which the formation had been bombing. With the tail of the machine on the ground and the nose sticking up in the air the crew had no way of keeping the Arabs off if they attacked them in front, although the aft gun could tackle them if they attacked on either side or at the tail. So the gunner, Flying-Officer Neville Vintcent, who is very tall and strong, lifted the tail-skid of the machine onto his shoulder so that the pilot could work the two front guns.

Apart from lifting the tail, Vintcent had to aim the machine at the on-coming Arabs, for the guns were fixed in the engine cowling. In this way they kept the Arabs off until others of their formation drove the horsemen away while two of the formation picked up the pilot and gunner.

Mr. Vintcent is now head of Tata Air Lines run by the great Parsee firm of Bombay, and one of the most important men in Indian Aviation. The pilot was Flt.-Lieut. J. T. W. Jones, commonly known as Taffy, who is now, I believe, a Group-Captain commanding a training station somewhere in England.

IMPROVISING IN BOMBERS

The Kurds, as I said, took much subduing, and as there were no big machines in 'Iraq to carry heavy bombs, one of the Vernon troop-carriers was sent. Squadron-Leader A. T. Harris, now Air-Marshall, recently Assistant Chief of the Air Staff, but later seconded for special duties, cut a hole in the bulbous nose of the machine so that a bomb-aimer could lie down and see through his bomb-sights, and he cut a big hole in the belly so that heavy bombs or salvos of bombs could be dropped through it. It was a remarkable success. But why he did not get into trouble for mangling His Majesty's aircraft I have not dis-

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covered. That is the kind of independent operation which no Treasury will stand.

One of the Vernons was put to a still queerer use, also very effective. Somebody had the brilliant thought that if only we could tell the Kurds that we did not want to hurt them and that we wanted them to keep quiet, they might behave themselves. Distributing pamphlets, or 'bomphlets' as they came to be called in this war, was no use because so few Kurds could read. So instead of that, an enormous loud-speaker was fitted in the belly of a Vernon with a powerful amplifier. The officer in charge of the outfit was Flt.-Lieut. P. J. R. King—now Group-Captain.

When it was all ready the machine sailed off over the Kurdish hills and a Kurdish policeman from Baghdad at the microphone told the Kurds just what would happen to them if they did not cease raiding the 'Iraqis. I do not know whether the engines were fitted with silencers so as to give the loud-speaker a chance.

The officer in charge told me afterwards, when I asked him how he made sure that the Kurdish policeman did not say the wrong thing, that he knew just enough Kurdish to keep tab on him, and had a revolver ready to plug him if he played the fool. That seems quite an improvement on the B.B.C. method of merely switching a broadcaster off if he dares to say something which isn't in the book. And I have heard many of them say things for which they ought to have been shot, if only for insulting the intelligence of their audience.

Anyhow, in about three years the Air Force did get control without occupation, and there was practically no trouble there until we handed the control of 'Iraq back to the 'Iraqis and they started having revolutions of their own.

THE IMAM YAYA

Another place where we had serious bombing to do was in the Aden Protectorate. That was the second place in the Em-

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pire which was handed over to the command of an Air Force Officer—Group-Captain Mitchell, commonly known as ‘Ginger’, who recently retired as Air-Marshal Sir William G. S. Mitchell, and is now Black Rod in the House of Lords.

His trouble was an old gentleman who lived among high mountains and was an Imam, or exalted priest, as well as being prince-dictator of a tract of barren country. His tribesmen made a habit of raiding the peaceful coffee-planters of Mocha on the Red Sea coast and of beating up our tribesmen in Aden territory.

His full name was the Zaidi Imam Yaya of Sana. The Zaidi are a Mahometan sect, Imam was his title, Yaya was his name, and Sana was his capital.

The mountains there run high, and one of our pilots remarked to me afterwards that climbing up to 8,000 feet to drop bombs on villages only 800 feet below struck him as a queer kind of war. Anyhow, we got the Imam Yaya under control without occupying his territory. And he remained very quiet for a number of years until he started scrapping with King Ibn Saud. But in that we were neutral.

We had also a little trouble with some of the tribes along the Nile, but that was easily dealt with by land machines from Khartum and a few Fairey IIF float-planes working off the Nile.

CHAPTER 9

The Air Wars of Foreign Nations



Somewhere around 1935 or 1936 the Japanese invaded China. They did not declare war, and consequently there has never legally been a war in China. But the Japanese started by bombing the Chinese towns surrounding Shanghai, and then, working up the Yangtse River, they bombed Nanking and then Hankow. After that they attacked various places down the coast and finally occupied Canton.

The Chinese, under General Chiang Kai Shek, moved inland and set up a new capital at Chung King, right in the western corner of China near Burma. In all these attacks the Japanese did a lot of bombing, but there is nothing much to be learned from it. Their bombers are home-built hybrids made up of English, American, German, and French designs, all mixed.

The Japanese are notorious for their imitations of anything European, whether it be a camera, or a bicycle, or any other mechanical contrivance. It is always rough and shoddy. And Japanese aeroplanes are likewise. But Japanese pilots are rather worse.

A friend of mine who spent several years in Japan trying to teach the Japanese to fly said that they fly all right so long as everything goes according to plan, but that if anything unexpected happens, which they have not been taught, they immediately clutch their heads with their hands and start wondering what the book says about it. By that time they have probably hit the ground.

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Nevertheless, because the Chinese had practically no pilots in the north at all, and have had very few since moving west, the Japanese Air Force, clumsy as it is, has had things all its own way. A number of Russian pilots flew for the Chinese, and until lately most of China's machines have been Russian. More lately a number of British and American aeroplanes have been sent to China by way of Burma.

Apparently they have all been fighters, because nothing has been heard of Chinese bombers attacking the Japanese. I have heard lately that the Chinese are making really good Chinese copies of English and American aeroplanes. The raw materials have been sent to them up the famous Burma road by truck from rail-head at Lashio. And now aerodromes are being built in Burma for serious air transport.

At the time of writing there are possibilities of the Japanese trying to attack Singapore or Burma by air. By reasonable reckoning, about fifty Australian fighting pilots—as Singapore is largely manned by Australians—would be enough to sink any possible bombing force which the Japanese could send against Singapore. Our pilots, whether British or Australian or Canadian, have proved that they can take on the German Air Force in a ratio of anything up to five to one or more. They have taken on the Italians in a ratio of between ten and twenty to one. And on that reckoning there are practically no odds in relation to them against the Japanese.

At the very most, the Japanese could not put more than 250 aeroplanes into the air at once from French Indo-China, so half a dozen formations of our people from Singapore ought to be able to dispose of that number of Japanese fairly easily.

THE ITALIANS IN ABYSSINIA

In the conquest of Abyssinia the Italian *Regia Aeronautica* had as easy a job as had the Japanese in China. There was nothing at all up against them. Although an American negro, who

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called himself 'The Black Eagle of Harlem', got much advertisement in the British Press, he did no fighting. But the Italian bombers had a lot of useful experience with various projectiles. In certain places they used big bombs, and in others they used small bombs purely against troops. In places they used incendiaries in large quantities to set fire to forests so as to separate one Abyssinian fighting force from another.

The Italian bombers carried the queerest sort of projectiles when they were supplying the army which marched direct from the Red Sea across the Galla Desert to the north-east of Abyssinia. The bombers carried loads of goats and sheep which they let down by parachutes to the troops in the desert, to keep them supplied with fresh meat. The dropping of ammunition and tinned food and water was easy. But animals' carcasses burst if dropped heavily, and, because of the heat dead beasts would not keep, so they had to get them down alive and in a state to march with the army till wanted as food.

In Abyssinia the Italians used up a lot of their obsolete machines. Naturally they wrote off many in landings on bad ground, and even their prepared aerodromes were very rough. But they also used a fair number of the earlier types of Savoia-Marchetti bombers, which on paper were the most efficient bombers in the world.

BOMBERS IN THE SPANISH CIVIL WAR

The Spanish Civil War, which began in 1936, demonstrated for the first time some of the possibilities of modern bombers. The Germans and the Italians supported the Nationalist Government under General Franco and the French and the Russians supported the Red Government.

At that time, which was at the height of the control of France by the *Front Populaire*, the work-people of France had practically gone Communist and were doing little or no work. In fact, as an historical fact, in one month the total output of the

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French Aircraft Industry was twelve aeroplanes. The result was that the French had no new types of bombers to send to Spain and the French Government contented itself with planting on the Red Spanish Government any old types of machines of which they wanted to be rid. And the Spaniards paid for them with real gold drawn from the reserves of the banks of Spain, which had been transferred to Paris as soon as Franco's counter-revolution began.

The Russians sent what they had in the way of bombers, which were mostly rough copies of the American Martin bombers. They flew quite well, but were not reliable, because of poor workmanship.

On the other hand, the Germans and the Italians both used the Spanish Civil war as a good chance of trying out their newest types. The Italian Savoia-Marchetti, built of steel tubing and plywood, was easily the best of the lot. Reliable British calculations at the time showed that a Savoia-Marchetti could carry a ton of bombs from Turin, in the north-west of Italy, to London, and still have enough petrol to get home.

The Germans tried out the twin-engined Junkers 88 monoplanes, and a few of the early Heinkel 111 and Dornier 215. But the bulk of the German bombers were the old Junkers 52, which is still among the safest and most comfortable passenger liners. This type was used for troop-carrying or bomb-carrying, as required.

In fact, the 52 was also used for the ordinary internal air lines in Spain which ran from Seville in the south to Vittoria in the north-west and thence across France to Switzerland and Germany, and eastward from Vittoria to Zaragoza, for the accommodation of people who were in a hurry, because the railways were bad. The line from Seville to the north actually ran for a short distance over enemy territory. Apparently the enemy did not think that these machines were so important as to be worth shooting down, for no fighters ever went up after them.

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BOMBING IN SPAIN

In spite of stories to the contrary there was little bombing of towns in Spain. General Franco, knowing that Spanish cities would be one of his assets after he had won, did not want to wreck them or kill the population, so, apart from battle-bombing, his bombers were sent only against the harbours to which war material was brought by sea, or else against the railways.

The Italian forces based on the island of Majorca (or Mallorca) bombed chiefly the harbours of Barcelona and Valencia. Their bombing was remarkably accurate, for, although they dropped their bombs from heights between 16,000 feet and 20,000 feet, they hardly hit anything except the harbour and the buildings immediately around it. Barcelona harbour was a mass of wrecked ships. Valencia was rather a different case because there were so many objectives of military importance in the city—munition factories and such.

Such coastal bombing was interesting because it was done so high up that the bomb-aimer had to pull the plug or press the button when somewhere between three and a half and four and a half miles away from the target. Which is about the equivalent of letting a bomb go when over Hammersmith so as to hit Hyde Park Corner. At that rate hitting the harbour at all was not so bad.

There was one excellent example of the oddity of bombing in that campaign. Some of the Nationalist bombers tried to hit a railway yard close to the French Frontier, where munitions which came from France were parked, overshot the mark and dropped a bomb or two on French territory. There were the usual protests and apologies, and orders were given to the bombing squadrons to be more careful in future.

Soon after this a brand-new formation, accompanying two more experienced formations, went up to bomb the same railway yard. The two senior formations, knowing their ground, dropped their bombs near the goods-yard and then looked back

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to see how the new formation was doing. Full of apprehension lest they might do the wrong thing, the new formation dropped their bombs a good mile or so behind those of the others.

When they all landed the older pilots pulled the legs of the new people about being afraid to trust their own bomb-sights. And they went on laughing about it for three or four days until the local French papers came through recording the fact that three formations of the Nationalist Air Force had attacked the railway yard, two of them had dropped their bombs near the railway, but the third formation had dropped their bombs *avec une précision mathématique* on the bridge which connected the goods-yard with the main line railway to the south, and so had blocked all train movements for weeks.

Naturally the French journalists on the frontier got news more quickly and accurately from their friends in Catalonia than did the Nationalists, who had to wait for the reports of their spies. How often in life are the greatest results achieved by luck more than by judgement?

About the only towns in Spain which were really destroyed in the fighting were Teruel, Brunete, and Belchite, and they were mostly smashed by gun-fire from both sides, as they were taken and retaken several times. At Teruel the most bombed area was the cemetery, which the Reds had made their front line. The results were most unpleasant.

FRONT LINE BOMBING

The bombing of trenches and prepared positions in battle was most interesting to watch. The Nationalists' method of attack was to machine-gun the trenches with a chain (*catena*) of single-seat fighters to put the defenders under ground. Then they sent heavy bombers over, low down to smash the trenches; then came another chain of single-seat fighters to catch the bombed-out defenders; and then the infantry attacked. The idea was to force the defenders into such positions that the

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attacking infantry could get close up without the people in the trenches being able to fire at them.

It was an excellent example of that close co-operation between army and air force which only a matter of two years later the Germans used so effectively against the French. The positions in France were entirely different, but the close co-operation was there—as I will show later.

The tactics in Spain were those of General Vigon, who had been military tutor to the sons of King Alfonso. He had a kind of roving commission which enabled him to co-operate with the various Army Commanders. And General Kindelan, a Spaniard of three generations, but before that of a North of Ireland family, who commanded the Nationalist Air Force, co-operated most closely with the Army Commanders and General Vigon.

Actually most of the bombing in the Spanish war was tactical. Apart from the bombing of the ports by the Independent Italian Force from the Balearic Island and the bombing of railways there was little strategic bombing.

Naturally there were some unfortunate incidents. A German bomber pilot who was trying to get a small-arms factory just outside the little town of Durango in the Basque country, put a bomb through the roof of the local church, which was full of pious people praying for peace regardless of politics.

The town of Guernica, which, according to popular reports, was destroyed by bombs, including the Basque Parliament House and its accompanying sacred oak-tree, was hardly bombed at all. I was there a few months afterwards. A close inspection was technically most educative. The Parliament House, the schools, the big convent next door, and the sacred tree (which has been dead for about a hundred years and is enshrined in marble) and its flourishing offspring, and the houses on each side of the valley in which the town is built had not been touched by bombs or fires. Many of the warehouses and shops in the main street along the line of retreat of the Asturian Army had been set on fire or blown up, with the sound tactical

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idea of blocking the progress of the Nationalists. The walls of bombed houses fall outwards. The walls of those were all standing and the debris had fallen inside, as the result of fires—one can study the same differences in London to-day.

There had been heavy bombing on the northern outskirts of the town on the retreating Asturian army—and as the Nationalist bombers flew along the valley over the town to reach the enemy, naturally they looked as if they were going to bomb the town. But whether by bombing or burning the town was by no means destroyed. The inhabitants were still there.

A curious thing was that the Nationalists did not bomb a good-sized small-arms factory which was comparatively close to the line of the retreating army, and the Asturians forgot to blow it up, so when the Nationalists walked through the town a few hours afterwards, they found the factory untouched and a stock of many thousands of automatic pistols which the enemy had forgotten to take away.

A quaint incident happened at the end of the fighting in which the great city and port of Bilbao were captured. The city lies in a valley surrounded by hills, except where the river cuts through to the sea. These hills had been heavily fortified by the local Government, who controlled the movement of the Basques and Asturians. With the help of up-to-date French military engineers they had built what was known as the Iron Girdle (*El Cinturon de Hierro*) of Bilbao. And it proved itself, small as it was, rather more effective than did the much-boosted Maginot Line in France. By skilful bombing and tactical attacks the Nationalists broke the Girdle and stood on the top of the hills looking down into Bilbao.

Low down on one of the hill-sides was a small factory which was making shell-cases for the Basque Army. An officer whom I knew, with another officer pilot, dropped some bombs into this factory and blew several holes in several floors, and broke some glass, but, as the shells were filled with explosives elsewhere no explosion followed. Next day along with the officer

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who had accompanied him, he went to this factory to see what damage they had done.

To his surprise he found the factory-hands at work. The foreman explained that they did not worry for whom they were working so long as they were paid. And he said, 'Yesterday we were making shells for the Reds, and to-day we make them for you.'

The point here, which applies to many millions of work-people in Europe, not only in this war which began in 1939, but in every war in the past and the future, is that working-people must eat—even out of the hand of the conqueror.

TYPICAL EFFECTS

Many things were learned about bombs in the Spanish Civil War. One was that an ordinary bomb which fell on ordinary ground went down a long way and blew up a steep crater and did surprisingly little damage. If it penetrated several floors of a house it probably blew them up.

Then somebody invented what has since become known as *personnel* bombs. These carry a rod sticking out of the nose, and when the point of the rod hits the ground the bomb bursts within a fraction of a second and blows out fragments all round itself along the surface of the ground, without penetrating. Thus anybody who is on the ground within a radius which depends on the size of the bomb, is pretty nearly bound to be hit. As a rule if people are lying down quite flat they are not likely to be hit, but there used to be a good deal of argument about whether a man lying down, by bad luck broadside on to the bomb, was more likely to be hit by fragments chasing along the surface of the ground than he would be if he were standing up and so presenting a narrower target for the fragments diverging from the burst bomb.

In the Spanish Civil War the Spanish pilots, of whom there were a good few before the war but many more trained during the war, were mostly notable as pilots of single-seat fighters.

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That is natural when one considers that the upper-class Spaniards are essentially *cabaleros*, and magnificent horsemen they are. The Germans were predominantly bomber pilots, and the Italians were about half-half. They had very good fighter pilots, but also many accurate bombers.

But some of the Spanish bomber pilots were very good. Notable among them was the Infante Alfonso, first cousin to King Alfonso. He had held a high command in the Royal Spanish Air Force before King Alfonso was deposed, and at the beginning of the Civil War he was living in France, more or less in exile. When the National Government under General Franco began to make headway in the north, with the help of the Navarrese *Requetes* and the Arragonese, under General Mola, who was later killed in an aeroplane crash, the Infante was allowed to join the Air Force. As his guest I flew from south to north, and west to east, of Spain, and saw what had been and was being done by bombers. One of the favourite diversions of the crews of the Savoia-Marchettis, after they had dropped their bombs, was to machine-gun transport on the roads with their cannon-guns. The Infante told me that he believed that these guns would sink merchant ships. I recorded the statement in print at the time (1938). Our four-cannon fighters are now doing it!

As a boy he had been at school at Winchester, and when he was about forty he had been attached for several years to our Royal Air Force, to learn our technical and administrative principles, before taking over a command in Spain. Still, there was some doubt at Nationalist Headquarters about letting a Prince of the Blood Royal join a Republican Air Force. Nevertheless he did, and was soon promoted to command a brigade of bombers.

By the end of the war, although over fifty years of age, he had made 200 raids over the enemy lines piloting his own three-engined Savoia-Marchetti—which was distinctly good for a man of his age.

Bombers between Wars

JUST BEFORE OUR WAR

The Spanish Civil War carried on until early in 1939. And thereafter, except for a little bombing of Hungarian villages by Slovaks, after the occupation of Czech territory by the Germans, there was no bombing until the German Army invaded Poland. In that campaign, so far as any reliable news can be gathered from the contradictory reports of those times, most of the bombing seemed to be rather in the nature of major tactics than of strategy. Bombing railways and ammunition dumps and troops within the battle zone is definitely tactical bombing. Possibly the bombing of Warsaw and some other Polish cities, with the idea of breaking up the moral resistance of the people, might be considered strategic bombing.

The general impression one gets is that the most effective bombing in Poland was done by the Stukas or Junkers 87's, in creating a flying barrage in front of the tanks, instead of the old creeping barrage which the artillery used to lay in front of the infantry in the War 1914-18.

We do know with certainty that some areas of Warsaw were heavily bombed. Some stories make out that the whole city was laid waste, others say that only points of military importance were bombed. The truth is probably between the two.

Internal evidence from Warsaw showed that people still work and live in the city in large numbers, and the trams still run, and the places of amusement are still open, if only for the pleasure of the conquerors. One account said that at least one house in three was smashed by bombs. If that were so then two out of three houses would probably be uninhabitable. And that seems to conflict with the acknowledged fact that Warsaw is still the operative capital of Poland, albeit under enemy rule.

CHAPTER 10

The Development of American Bombers Between Wars



An interesting fact in the development of bombers between wars is that although the United States had no wars on hand, and officially had no troubles, the U.S. Army and Navy Air Services and Aircraft Industry from 1918 onwards took a lot of interest in the design and experimentation of bombers.

Unofficially and almost subconsciously the American people, especially those of the Pacific Slope, have lived not exactly in fear but at any rate in a lively apprehension of a Japanese attack on the Pacific Coast. There was a common belief that there were many divisions of Japanese troops disguised as peasants and fisherfolk in western Mexico, and that Lower California was practically a Japanese garrison. And anyhow, there was always the possibility of the Japanese Fleet bombarding the Pacific ports.

That no doubt accounts for the great size of the U.S. Naval Air Service in proportion to the U.S. Pacific Fleet, and for the attention given to the development of aircraft-carrying ships by the U.S. Navy and to the development of bombers by the U.S. Army.

Although the U.S. Aircraft Industry made great, if somewhat muddled, efforts between the time when the States entered the War in 1917 and the Armistice of 1918, comparatively few American-built aeroplanes got to France. All those which did

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arrive were American-built D.H.4's, built to the design of Geoffrey De Havilland of the Aircraft Manufacturing Company Ltd. at Hendon. They had the American 12-cylinder Vee-type water-cooled Liberty engine of 400 h.p. The general arrangement of this engine was designed in a single session of twenty-four hours by Mr. Vincent of the Packard Company and Mr. Hall of the Hall-Scott Company.

That was the same engine which did so well in our old D.H.9A, for many years in the between-wars period. But apart from those D.H.4's and two samples of an American built fighter, no American aeroplanes crossed the line in France. But after the war the U.S. Air Services went on steadily developing.

Nothing proves the common racial origin of the Americans and English so well as does the astounding muddle into which the industries of the States got themselves in 1917 and out of which they were extricating themselves when Peace broke out in November 1918.

General William Mitchell, who in France during the Battle of the Argonne had himself led into the air the biggest air force which operated under a single command during the war—it was made up of American squadrons in French and English machines, and of French and English squadrons operating under General Mitchell's orders—paid particular attention to the development of bombers.

The Curtiss Company, whose big flying-boats had been such a success during the war, naturally turned their attention to bombers a year or two after the Armistice. Glenn Martin, whose twin-motor bombers have now been famous for years, began this line of business by turning out a two-engine mail-carrier with two Liberty motors which was practically identical with his torpedo-plane of the same period. And from this developed his famous M.B.R. of 1921, with two Liberty motors and lots of guns.

Mr. J. V. Martin, no relation to Glenn, and a sea-captain by trade, who claimed to have invented the retractable under-

The Development of American Bombers

carriage, built what he called the 'Seven-Ton' bomber. It was remarkable for having two engines, totalling 908 h.p. in the fuselage, and driving twin screws through gearing and shafts. It had not much of a performance and it was not developed any farther. But it showed progressive ideas.

In 1920-1 a firm called the L.W.F. Engineering Corporation built a huge biplane with two fuselages, three Liberty motors, of 420 h.p., and three rudders, which was intended to be a night bomber. It was not so big as the V-1500 Handley Page, but it was America's first attempt at a really big aeroplane.

There is interest in noting that in 1920-1 the U.S. Army Air Service had only nine bomber squadrons out of thirty-seven squadrons in the whole Service, which indicated a concentration on defence.

Not to be outdone by Mr. Handley Page, the U.S. Army itself proceeded to build a colossal triplane with *six* Liberty motors of 400 h.p. each. I saw it when I was in the States in 1924, and it just managed to lift itself off the ground. It was known as the Barling Bomber, as it had been designed by a Mr. Barling who had been concerned with the design of the six-motor Tarrant Triplane, which had been built at Byfleet near Brooklands, and assembled at the Royal Aircraft Establishment at Farnborough, and unfortunately broke up on the ground before it got into the air, and killed its pilot.

Mr. Barling's effort in America was more fortunate in that it did fly. That such a colossal thing should have six engines, which between them turned out about as much power (2,400 h.p.) as one single engine (the Sabre) which is used in our latest fighter of 1941, the Hawker Typhoon, to take one man and a bunch of guns into the air, seems queer in these days.

The U.S. Navy had an interesting machine for those early days, which will probably be remembered by older members of aviation. That was the Curtiss C.T. torpedo-dropper, a twin-motor low-wing monoplane float-plane—I think that it was the first twin-motor low-wing monoplane ever built. It had two.

Bombing between Wars

Curtiss D-12 motors of 400 h.p. The monoplane wing had a span of 65 feet, was 30 inches thick in the centre section and the chord was 15 feet, and the wings tapered in chord and depth, which made it very graceful.

The floats were of a type designed by Commander Richardson of the U.S. Navy, and it had no fuselage. The tail was carried on four booms. The upper booms were connected to the centre-section of the wings in line with the engines, and the lower booms joined the undercarriage struts on the floats.

The useful load of the machine was 3,280 lb. and it had a speed of 112 m.p.h.

In 1923 the U.S. Army Air Service ordered from the Curtiss Company fifty twin-motor bombers, built to the design of the Curtiss Company's great rival, Glenn Martin. These had two 400 h.p. Liberty motors apiece. Why they were not built by Glenn Martin himself I do not know, because his shops in Cleveland, as I saw them in 1924, seemed to have plenty of capacity. But I think he was building mail-planes at the time.

Anyhow, these Curtiss bombers had a part in one of the most convincing and educative bombing experiments which have ever happened.

BATTLESHIP BOMBING

In the United States at that time, as in England, there was much bitterness between the Army and the Navy. Some of the senior admirals scoffed at Air Power. They probably suffered from what is now called an inferiority complex. Anyhow, they did their best to prove that the Navy's ships were not afraid of Air Power.

In England the R.A.F. begged to be allowed to use one of the surrendered German warships as a target for real live bombing. And the Navy refused to let them have it. But I wish that I had room here to write of the bombing trials with H.M.S. *Agamemnon* as the target and light-practice bombs as projectiles.

The Development of American Bombers

In the States the Navy's aviators tried to persuade the senior admirals to let them sink two of the surrendered German war-ships, a battleship and a cruiser. Finally the admirals agreed to let the Naval Air Service give a demonstration of bombing, but they so limited the size of the bombs which the Air Service were allowed to use that they were useless.

So, on a day, the ships were taken out to a point about eighty or ninety miles from the coast and anchored there. Then the Naval Air Service people dropped their comparatively harmless little bombs and the results were inspected by observers from a warship which was sent out by the Navy Bureau, bringing with it Army and Navy officers and Pressmen and politicians, to be shown that Air Power could not sink battleships.

This had been demonstrated to the satisfaction of the admirals when from the direction of the coast a two-seater aeroplane appeared which circled round the two target ships. Shortly afterwards a string of twin-motor bombers bearing the markings of the U.S. Army Air Service came along and proceeded to bomb them properly.

One bomb abolished completely the top-hamper of the battleship. Several bombs fell in the water and gave quite a bad shaking to the ship which was acting as grandstand. Then a very big bomb just missed the battleship, and burst in the water close alongside her. The explosion hove the ship clean out of the water and broke her back, so that she sank in a few minutes. Another bomb hit the stern of the cruiser, and shook it so badly that it leaked, and the ship settled down quietly by the stern, and sank within, I think, an hour or so.

The effectiveness of this 'near-miss' bombing of ships with bombs carrying slightly delayed action fuses is at last being understood in this war.

The leader of these air pirates was General Bill Mitchell himself, and the bombs which his twin-motor machines were carrying weighed, I think, 2,000 lb.—which would be considered quite big to-day.

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I have never been able to get the exact figures of that performance. There was talk of one of the bombs being a 4,000-pounder, but I rather doubt whether the twin-motor bombers of the time could have carried one bomb of such a weight.

Of course there was a glorious row. The old admirals accused Mitchell of not playing fair, and pointed out that the two ships were built before the war and were not armoured as were more modern ships, and were nothing like so well protected by anti-aircraft guns as would be the ships which were then being built, or which would be built in five or ten years' time.

That was reasonable enough, but it did not make any allowance for the fact that the finest twin-engine bombers which Bill Mitchell used were not at all like the enormous weight-carrying bombers which would be built by the time the Navy's new and heavily-armed ships were built.

Our own experiences in the Mediterranean and the experience of the Germans in the Atlantic have by now convinced even the most sceptical sailorman that bombers and torpedo-craft, which are the same thing only that they use a different weapon, can sink the best of seagoing ships, or so damage them that they can be sunk by other means, as was the *Bismarck* and the Italian ships off Cape Matapan.

Bill Mitchell was one of the greatest of the apostles of Air Power. And like so many apostles and prophets he became a martyr for his faith.

When I was in Washington in 1924 he showed me in his office maps of the Atlantic and the Pacific demonstrating what could be done by organizing air defence against attack by sea. He started by a line marking a belt round the coast which could be covered by the aeroplanes of those days. He trusted them to go 200 miles out to sea and back, and he visualized that in a few years they could do 500 miles out and back safely. To-day our sea-patrols from Great Britain and Newfoundland meet in mid-Atlantic.

In that map of the Atlantic a 500-mile belt round the coasts

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on each side showed a comparatively small space in the middle which could not be reached safely by heavily armed shore-based aircraft. Mitchell, pointing to the space in the middle, said, 'And that's where the navies of the world can go and mill around and sink one another.'

The sinking of the German battleship *Bismarck* in 1941 showed what ship-borne aircraft can do against modern war-ships. And the *Bismarck* was never attacked by any of our big heavy bombers. Although it came well within their reach they were not sent out against her. The light bombs and torpedoes of our Naval Air Service were enough to slow the ship down and make her an easy mark for our heavier ships.

Mitchell tried, by writing and speaking, to induce the U.S. Government to form an Air Force independent of the Navy and the Army, like our R.A.F. But vested interests had too much power for him. In the end he was court-martialled and cashiered for agitating against the orders of senior officers. And so the U.S. Army lost one of its best and most far-sighted air officers—but Bill Mitchell lost none of his friends. They and a charming wife enabled him to endure exile from the Service he loved and to live the life of sporting country gentlemen till his premature death in his early fifties.

[NOTE TO SECOND EDITION. The attacks by Japanese bombers and torpedo-droppers in the Pacific, the lamentable tragedy of Pearl Harbour, the sinking of H.M.S. *Prince of Wales* and of H.M.S. *Repulse*, the capture of Manila, the occupation of most of the Pacific Ocean by Japanese ships backed by Air Power, very largely operating from shore bases, have proved and justified everything that Bill Mitchell said or did.

The U.S. Government, big enough to acknowledge the errors of its predecessors, promoted William Mitchell *posthumously* in January 1942 to Full General, the rank which he would have reached by that date if he had remained in the U.S. Army.

I remarked to one of his friends, 'How Bill Mitchell's ghost must be laughing, wherever he is.' And the friend replied: 'I wonder whether his ghost still wears jodhpurs.' Funny how the little oddities of one's friends stick in one's affectionate memories of them. Bill Mitchell was one of the finest horsemen in America.—C. G. G.]

CHAPTER 11

The New Order in U.S. Aviation



By 1924-5 the Curtiss Condor twin-motor biplane bomber had appeared. Nobody else in the States was making any big bombers except Glenn Martin, whose bombers were being built by several secondary contractors.

The most significant step forward had been taken in 1924 by William B. Stout, commonly known as Bill Stout. He produced the first all-metal monoplane in the United States. It was built of corrugated aluminium, like a Junkers. The first example was a single-engine job, designed to be a mail-plane, and it was known jestingly as Bill Stout's Tin Balloon. But it was quite a good aeroplane, and it started the new fashion for all-metal monoplanes. The Detroit Metal Airplane Company, which made it, was in fact the airplane division of the Ford Motor Company.

From that Bill Stout developed the Ford Trimotor, an all-metal monoplane, which became famous all over the world and might have rivalled the Junkers 52 but that Mr. Ford lost interest in aviation. Bill Stout became famous in the aircraft industries of all nations because in his design department he placarded the walls with the immortal phrase, 'Simplify and Add More Lightness'. The pity is that so few designers took his advice.

Certainly no simpler aircraft has ever been built than the Ford Trimotor. If he had been allowed to go on, Bill Stout

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might have improved the qualities of aeroplanes not only in the States but in all other countries.

The year 1926 was interesting because in it the first twin-motor Douglas warplane appeared. Also in 1926 came the beginning of high-powered radial air-cooled motors in the States. The Douglas effort was particularly interesting because, although it had two 500 h.p. Wright engines, it was classed as a deck-landing bomber. How the Navy proposed to carry such a big twin-motor biplane, 'tween-decks I do not know.

Here I may note that two years earlier Douglas had built several single-motor two-seaters, in which a dozen officers and men of the U.S. Army Air Service started to fly round the world—or rather the top quarter-sphere. Most of them got as far as England, but only two completed the journey.

Also in 1926, although the firm was incorporated in 1923, we hear for the first time of the Consolidated Aircraft Corporation, which was founded by Major Reuben Fleet and Colonel Virginius Clark, who until they started this company had been two of the most valuable technical officers in the U.S. Army Air Service. Virginius Clark became famous later as the producer of the 'Clark Y' wing-section. The Consolidated Liberator bombers and Catalina flying-boats are about the best-boosted aeroplanes of to-day, and are very good flying-machines.

I wish there were more room in this book to go more closely into the history of American bombers. One finds firms which are now dead, then starting on really ambitious schemes for big bombers. And one finds also strange survivals.

For example, the Remington-Burnelli, which started out with the idea of being a twin-motor biplane, the fuselage of which was shaped like the section of a wing to give it lift and higher efficiency, still survives in the Cunliffe-Owen version of the Flying Wing which was built in 1938-9. In August 1941 some of the papers announced, as if the machine were a great new discovery, that the one and only original Flying Wing had been flown to West Africa to become the flagship of General

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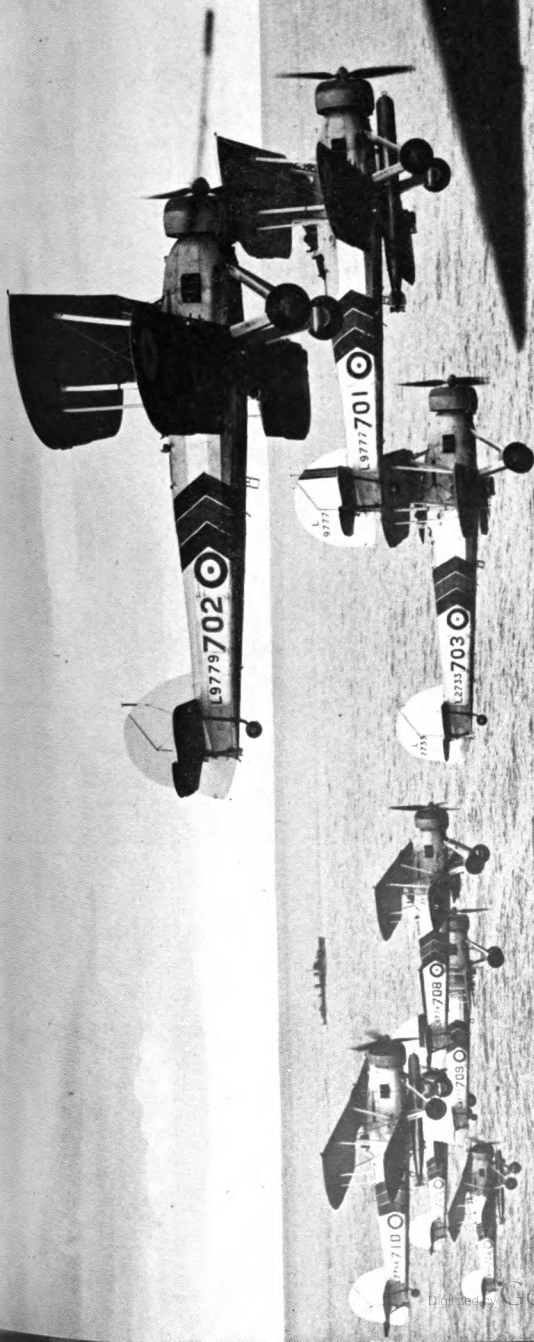
de Gaulle's Air Fleet in the Cameroons or the Gaboons or something of that sort. Nothing less like a modern war machine can be imagined. And the machine which existed in 1941 was purely a new experimental version of that which existed in 1926 or thereabouts. If it were built in a colossal size the idea would certainly have immense possibilities.

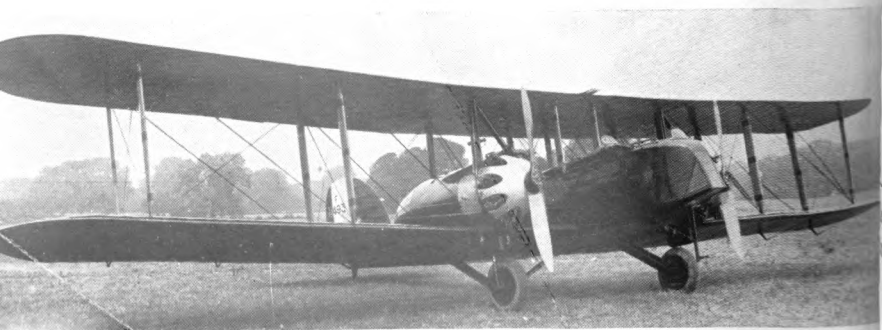
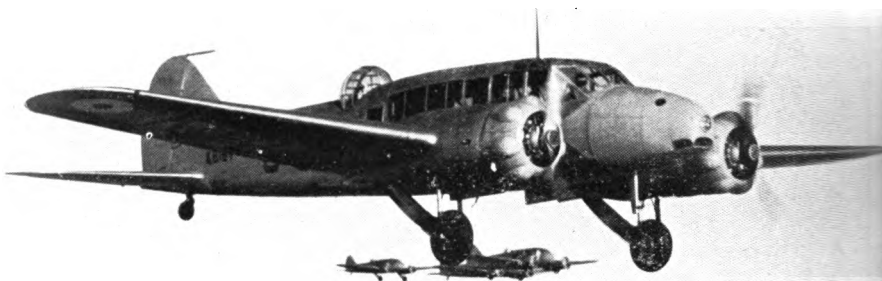
Boeing's first step towards the Flying Fortress and the stratosphere fleet was made in 1927, when he turned out a twelve-passenger biplane with three Pratt and Whitney Wasp motors of 425 h.p. That was built for use on the San Francisco section of the Trans-Continental Air Mail Route, which was then operated by Boeing Air Transport Incorporated.

The U.S. Army Air Service in 1927 acquired a number of bombers built by the Keystone Aircraft Corporation, the head of which was E. N. Gott, who had been Boeing's right-hand man. The name Keystone was best known in the Western Hemisphere because of the firm's crop-dusters; machines which flew low over tobacco crops and such-like and sprayed them with disinfectants. The Keystone Super-Cyclops bomber, which had two 550 h.p. Packard water-cooled cylinder motors, had a span of 85 feet, a length of 21 feet, and a height of 18 feet. With that it had a top speed of 110 m.p.h. The weight of the machine empty was 9,330 lb. and its weight loaded was 16,000 lb., so it was fairly efficient. But it was not very fast.

In 1927 also appeared the first of those extraordinarily pretty and highly efficient Lockheed single-motor monoplanes from which have developed the twelve-passenger Lockheed aeroplanes which we have turned into bombers and called the Hudson.

During these years the American fashion for all-metal construction was growing and growing. The Aluminium Company of America produced a metal called Alclad which consists of a





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sandwich in which a sheet of Duralumin, which is highly corrodible, has a sheet of raw aluminium squeezed onto each side so that the whole thing becomes one inseparable mass. The Duralumin gives the needed strength and the aluminium on each side prevents it from oxidizing.

Lately there has been much agitation in the States because of shortage of all aluminium alloys. Charges have been made that the aluminium factories of America have not been turning out as much material as they might, and not nearly as much as was wanted. Strong competition has arisen in the States from independent industrialists who allege that they can increase the output of aluminium far beyond that at present available. I mention this because the output of American bombers depends wholly on the supply of aluminium.

AFTERTHOUGHT

‘The optimism of scientists is sometimes a little touching, but it is rapidly losing the arrogance which still clings to those pseudo-scientists who want to rid the World of all knowledge which cannot be acquired in the laboratory.’

DR. G. J. REMER, *The Future of the English*.

Plate 6. Avro twin-motor types: Anson (1941); Manchester, Mark II (1917); and a bomber of 1918

CHAPTER 12

The Peak of the Boom



In 1927 the Curtiss Condor appeared as an authentic night-bomber with two 600 h.p. Curtiss Conqueror motors. The Conqueror looked like being a very good engine, for it was the direct successor of the Curtiss D.12, which in its day was the best 12-cylinder water-cooled engine. But for some reason which has never been publicly explained, the Curtiss people dropped the Conqueror after a few years and from that time until the Allison motor was developed, by General Motors Ltd., in about 1938, the U.S. were practically without a first-class water-cooled or liquid-cooled motor. The reason probably was that the Curtiss Company amalgamated with the Wright Corporation, and the combined firm went over to radial air-cooled motors, the Whirlwind, the Cyclone, and that series which had been developed by the Wright Corporation from the original air-cooled radial engines originally developed by Mr. Charles Lawrance.

The Keystone Corporation went in largely for multi-motor machines about this time. They built an eighteen-passenger cabin monoplane called the Patrician, with three Wright Cyclones of 525 h.p. They built a revised Pirate with two 420 h.p. geared Liberty engines, and the Panther with two 525 h.p. Wright Cyclones. These and the earlier Super-Cyclops were biplanes.

In 1929 there was little new development in the States. Per-

The Peak of the Boom

haps the most notable progress was shown by the Trimotor Ford, which, although it was purely a passenger machine, did provide a lot of experience which was later useful in building bombers, after Mr. Ford lost interest in flying in 1930 and Bill Stout's selected designers, draughtsmen, and workmen had drifted off to other aircraft firms.

In 1930 Boeing produced a single-motor low-wing monoplane with a 575 h.p. Pratt & Whitney Hornet, which was the first aeroplane of such a size to have a retractable undercarriage. It had a top speed of 158 m.p.h., and, on an empty weight of 4,600 lb. it carried a disposable load of 3,400 lb., of which about 2,000 lb. was pay-load. So it would have made a very good bomber.

Round about 1929-30, at the peak of the great false financial boom, aircraft financiers in the States ran mad. Colossal corporations were formed without apparently any limit to their capital and without any nominal value on their shares. The price of a share was what the market said it was. And so, following the course of the history of any individual firm became difficult. Big corporations owned air transport lines, aircraft factories and engine factories, all at the same time.

Clement Keys, who amalgamated the Curtiss and the Wright interests, bought up the Keystone Corporation and formed one of the biggest groups of the lot. The Consolidated Aircraft Corporation under Reuben Fleet, of which Lawrence Bell was then General Manager, controlled another great group. The Lockheed Company became a division of the Detroit Aircraft Corporation, with Gerald Vultee as its chief engineer.

About the only firm which preserved its complete individuality and did not amalgamate with or buy up or be bought up by anybody else was the Glenn L. Martin Company of Baltimore. The success of his company is an outstanding example of what one man can do if he sticks to his job. In 1932 Martin produced his model 123, the first twin-engine mid-wing monoplane bomber in America. It had two 650 h.p. Wright Cyclones,

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geared and supercharged. Also it had electric inertia starters. But a queer thing about it was its open cockpits, one of them at the nose for the gunner, one in the middle, just about level with the leading edge, for the pilot, and one for the gunner aft. Otherwise in general lines it was quite like the Maryland of to-day.

Another of the great amalgamators of air interests in the States was Mr. E. L. Cord, who formed the Airplane Development Corporation, bought up Lycomings, Stinsons, and sundry other firms, and put Gerald Vultee, late of the Lockheed Company, in charge of the technical side.

Like all booms, that which reached its peak in 1929-30 was followed by a huge slump. As an American friend wrote, 'The bread-lines at the relief kitchens are half a mile long, *and* the American automobile trades' sale of luxury cars has beaten all records.' A queer paradox, which may explain how the Aircraft Trade kept going.

CHAPTER 13

The Era of Big Monoplanes



The Boeing Company produced their first twin-engine monoplane bomber in 1932. In some attitudes it was much more like the Short Stirling of to-day than like the Flying Fortress or the Stratoliner or any of the other Boeing products. I think that it was the first American twin-motor bomber to have a retractable undercarriage.

In 1932 Donald Douglas, who had managed to retain his independence, produced the first of the Douglas (D.C.) all-metal twin-motor low-wing monoplanes which have become so well known in all continents. It had two super-charged geared Wright Cyclones of 710 h.p. each, its top speed was 210 m.p.h., and its useful load was 5,120 lb. That was the direct ancestor of the Douglas Boston and Havoc which are serving us so well.

During 1933 the Martin twin-motor bomber developed proper covered cabins, and began to look still more like the modern Maryland.

The Lockheed interests were bought out of the Detroit Aircraft Corporation group in 1932 by a new group headed by Lloyd Stearman. Hall F. Hibbard became Vice-President and engineer. And he produced the famous Lockheed Electra ten-passenger commercial monoplane with two 400 h.p. Pratt & Whitney Wasp-Junior motors, which made the fortune of the Lockheed Company. Of the Brothers Gross, who are now the leading spirits of the firm, Robert Gross was then Treasurer.

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He became Chairman in 1935, when Stearman went to Washington and joined the N.A.C.A. The Electra was remarkably like the Lockheed Hudson of to-day, except that it was not quite so tubby. It had the same twin-fin rudders, and the same nicely shaped wings and nicely placed motors. Also it had a retractable undercarriage.

In 1933-4 Glenn Martin produced the 139 bomber monoplane with two Wright Cyclones, which became part of the regular equipment of the U.S. Army Air Corps.

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The Boeing Aircraft Company, from which Mr. Bill Boeing himself had departed, with I hope adequate compensation, during the great boom, produced its first four-engined monoplane in 1935. It had four 700 h.p. Pratt & Whitney Hornets with three-blade controllable-pitch airscrews. It had a retractable undercarriage and tail-wheel, and, according to rumour, it was the first American aircraft to have air-brakes—which means the same sort of thing as the dive-bombing flaps on modern machines.

Because it had gun-positions, rather like the stream-lined side-lights on a modern motor-car, sticking out from the sides of the fuselage and under the belly, and on top, so that it was to some degree self-defensive, it was forthwith labelled, or libelled, as the 'Flying Fortress'. Considering that the prime idea of a fortress is that it shall be so heavily constructed that it will be proof against attacks by engines of war, the name was singularly ill-chosen, for the thin Alclad sheet used in the structure of aeroplanes can nearly be slit with a knife.

There is interest in noting that the machine was designed to conform to a U.S. Air Corps specification, so the U.S. Air Corps can claim the credit, if any, for having first conceived the idea that many men and thousands of pounds of bombs in one vulnerable aeroplane have greater weapon-value than the same

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amount of explosive carried by a smaller number of smaller and much faster aeroplanes controlled by a much smaller number of men.

The Air Corps specification called for a top speed of between 200 and 250 m.p.h. at 10,000 feet; an operating speed of 170 to 220 m.p.h. at that height; an endurance, or range, at operating speed, of between six or ten hours; and a service ceiling of between 20,000 and 25,000 feet.

That was quite sound in 1930 or 1931, when the specification was issued. And you will notice that the U.S. Air Corps at any rate had no notions of so-called Stratosphere flying.

The prototype had a span of 100 feet, a length of 70 feet, and a height of 15 feet.

By 1936, when Great Britain had started the panic expansion of the Royal Air Force and built 'shadow factories'; and Dr. Heinkel had already produced the Heinkel 111 bomber, which was then classed as a commercial monoplane, as well as single-seat fighters; and Dr. Dornier was making a lot of bomber-transport monoplanes with two motors; the aircraft manufacturers in the States began to see that the cultivation of military aircraft promised a good crop. But only the really big firms tackled the job.

The Flying Fortress continued its development. The Curtiss people produced a twin-engine attack monoplane with two 1,000 h.p. Wright cyclones which looked like a very useful high-speed medium bomber. Douglas produced the DB-1, also with two 1,000 h.p. Wright Cyclones. This was his first twin-engine military monoplane. It was in fact an adaptation of the famous DC-2 transport machine. But by this time the DC-3 transport had developed and was already ahead of the Douglas bomber in performance.

By 1937 Boeing Fortresses were already flying in formation. And Douglas had his DC-4, a forty-passenger commercial transport plane, on the way.

In 1937 we hear for the first time of North American Avia-

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tion Inc., with Mr. J. H. Kindelberger as General Manager. He was formerly Vice-President (Engineering) of the Douglas Company. N.A.A. Inc. was organized in 1928 as a holding corporation of various aircraft and airline companies' shares.

In 1934, after getting rid of a lot of dead wood, the firm was reorganized into an operating company and formed a Manufacturing Division which consolidated the interests of what had been the Fokker Aircraft Corporation and the Berliner-Joyce Aircraft Company. New works were built at Los Angeles and production began in 1936.

The firm evidently started under favourable auspices, for it immediately set to work hard on basic trainers and observation planes and fighter trainers for the U.S. Army Air Corps. By 1937 it had produced a two-seater general purpose monoplane called the MA-16-1A, with a 550 h.p. Wasps. This was the machine which was brought into the R.A.F. as the Harvard and was produced in a somewhat varied form in Australia as the Wirraway.

IN TIME FOR WAR

Mr. Lawrence Bell, formerly Vice-President and General-Manager of the Consolidated Aircraft Corporation, formed the Bell Aircraft Corporation in 1935. In 1938 he built for the U.S. Army Air Corps a twin-motor pusher bomber-fighter monoplane called the Airacuda. It is one of the most interesting machines of to-day.

The engines are placed between the spars and drive the air-screws behind the trailing edge through propeller-shafts. In front of each engine is a gun-pit in which is a man and a 37-mm. cannon. And there are four machine-guns in the nose of the fuselage. Mr. Bell told me, in 1937, that he reckoned that the nose of a twin-motor airplane was like Piccadilly Circus, there was too much traffic going around in it. So he put his big guns and gunners in front of the big Allison motors where there

The Era of Big Monoplanes

was plenty of inertia to take the recoil, and left the pilot and the light guns and the bomb-aimer in the nose.

In 1938 the Douglas DB-4 appeared. It was, or rather is, a very big monoplane which has four Twin-Hornets of 1,400 h.p. apiece. It was the first big aeroplane in any country to have a nose-wheel on which to land—or a tricycle undercarriage, as it is commonly called.

In 1938-9 the Douglas Company built a number of twin-motor light bombers known as the DB-7 for the French Government. A few were delivered in the early days of the war, but the bulk of them were not finished before the French collapsed and so they were delivered to Great Britain. This is the machine which is now known so well, and liked so well, as the Boston bomber or the Havoc night-fighter. It also has a tricycle undercarriage. Its worst fault is that it lands very fast.

Opinion in the R.A.F. is still much divided on the subject of tricycle undercars, and many doubt whether a nose-wheel is worth while. There may have been something wrong in the way in which our pilots were taught to land with tricycle undercarriages, or maybe the tricycle undercarriages we have had were only intended for use on concrete runways. The fact remains that many nose-wheels or their mountings have crumpled up, and some people have been hurt when the nose of the machine has hit the ground hard.

By 1939 the Lockheed Electra had developed fully as the Lockheed Hudson in the R.A.F. The 1939 versions of it had two 1,100 Wright Cyclone engines instead of two of the original 500 h.p. motors. An electrically driven gun-turret had been fitted very far aft, guns had been fitted in the nose, and altogether it had been turned into a useful medium bomber, well able to protect itself. By the end of 1933 it had done an enormous number of hours' flying over the North Sea, chiefly as a Coastal Command escort for our shipping.

Glenn Martin had progressed a good bit, and the old model 166 twin-engine bomber had been succeeded by the 167, a

Bombers between Wars

bomber reconnaissance monoplane which had two Wright Cyclones. It was a very nice looking all-metal machine and has been doing good work.

North American Aviation Inc. had by then progressed beyond the Harvard stage and had produced a three-seat attack-bomber called the N.A.40 with two Wright Cyclones. Its top speed at 17,500 feet is alleged to be 314 m.p.h. and its service ceiling 26,500 feet. It also has a tricycle undercarriage.

U.S. AIRCRAFT AT WAR

At the end of the second year of war one can say that American aeroplanes which have been sent to the R.A.F., whether in Great Britain or in the Middle East or the Far East, have been good. Although this book is not concerned with fighters, I can say briefly that the Airacobra and the Curtiss Tomahawk, and its latest version the Kittyhawk, come within measurable distance of being as good as our Hurricanes and Spitfires. All the American machines fly well, but their trouble is that they do not pack enough guns and so lose weapon-value.

No doubt, in due course, the U.S. Aircraft Industry will produce something as good as the much more powerful Typhoon and Tornado and the very latest Spitfires and Hurricanes. At the time of writing we are looking forward with pleasurable anticipation to the twin-motor, twin-tailed Lockheed Lightning.

Among the bombers the Douglas DB-7, or Boston-Havoc, has done extremely well as a bomber and night-fighter. And the pilots like flying it. The Martin Maryland, although now a trifle old, has well earned its keep in the Middle East and North Africa.

According to Air Ministry communiqués at the end of the second year of war the Boeing Fortresses had only been used experimentally. The Consolidated Aircraft Corporation had been supplying us with Catalina flying-boats, which have been most valuable. They have also sent some of their four-motor

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bombers, which we call the Liberator, which is the firm's Model 32 (U.S. Air Corps XB-24). They have four 1,200 h.p. Twin Wasps, and a span of 110 feet, a length of 60 feet, and a height of 19 feet. Fully loaded they weigh about 41,000 lb. (between nineteen and twenty tons). They are moderately fast.

Gerald Vultee, who started with Lockheeds, went into the employ of the U.S. Government. Later he formed the Vultee division of the Aviation Manufacturing Corporation, which in 1940 acquired the Stinson Aircraft Division of the Aviation Manufacturing Corporation and proceeded to make a variety of craft, one of which, the Vanguard, is a fine fighter. But there is also a dive-bomber which will come in useful.

Altogether, whether they be leased or lent, the American aircraft are gratefully received. As our Minister for Aircraft Production, Lieut.-Colonel J. T. C. Moore-Brabazon, M.C., said in August 1940: 'We make better and bigger bombers, and fiercer and faster fighters than any country in the World.' But we do not compete with some types—such as Stratoliners, or sub-Stratosphere bombers—which are built in the States. Our Halifaxes and Stirlings and Manchesters are much bigger and carry more and are faster, but they are not supposed to go so high. And we have not developed 'Hell-Divers' or dive-bombers much. So here the U.S. have things all their own way.

In this section of the book I have not dealt with the year-by-year development of British aeroplanes, because their growth will be found in detail in the section in which appear the biographies of those British firms which are making the bombers which are being used in the war at the end of its second year. I have not dealt with French bombers at all, because they have done nothing and there is nothing to learn from them. And what we have learned about German bombers will appear in Part III.

PART 3

Bombing in This War

*For this is our England, green-garbed, glorious,
Encircled in emerald, fringed with foam.
By the pity of God she shall stand victorious
In her guardian seas, in her grey skies' dome.
Aye; though she suffer for hell's unlidding,
Mother of men, in her true time's bidding,
She shall smite in her might, for a monster's ridding.
There is none in her likeness, and none such home.*

GEOFFREY DE HOLDEN-STONE, 'Plane Song'.

CHAPTER 14

Bomber Strength in 1939



When war began on the 3rd of September 1939 the British bomber force consisted of many squadrons of Bristol Blenheims, Armstrong Whitworth Whitleys, Vickers Wellingtons, and Handley Page Hampdens, all under the Air Officer Commanding-in-Chief, Bomber Command, Air Chief Marshal Sir Edgar Ludlow Hewitt, K.C.B., C.M.G., D.S.O., M.C. Detailed descriptions of these craft will be found in the later pages of this book. There, those who do not know their stories may study them so that they may understand better the discussion of bombing, and those who do know them may like to refresh their memories with details of the machines. These were the main strength of the bomber force.

With these we must include many hundreds of Fairey Battles which were originally designed as single-motor reconnaissance-bombers; a lot of little twin-motor Avro Ansons; and quite a good number even when war began of Lockheed Hudsons. Besides these we must include the Fairey Swordfish and Albacores and the Blackburn Skuas of the Naval Air Service, commonly called the Fleet Air Arm.

For several months after war had officially begun there seemed to be some kind of silent agreement between the politicians or the High Commands on both sides, that there should be no bombing of positions on land. All the attacks seemed to be against ships on both sides.

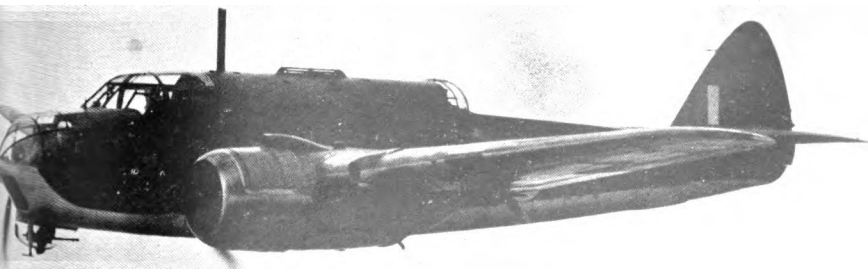
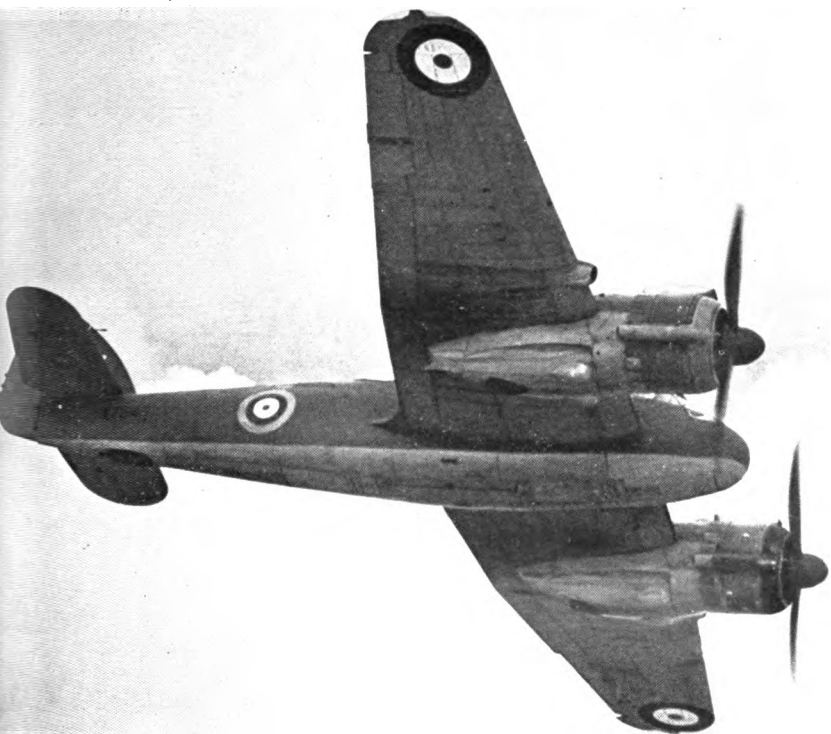
Bombing in This War

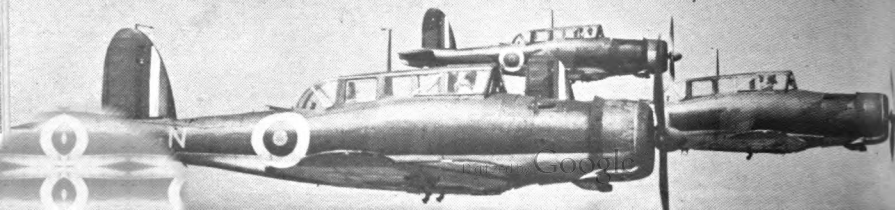
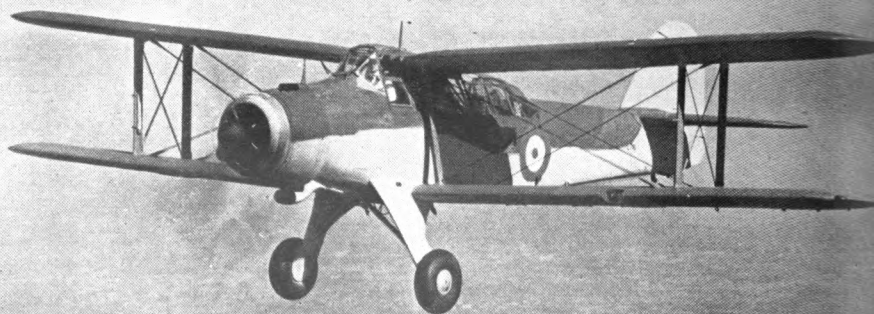
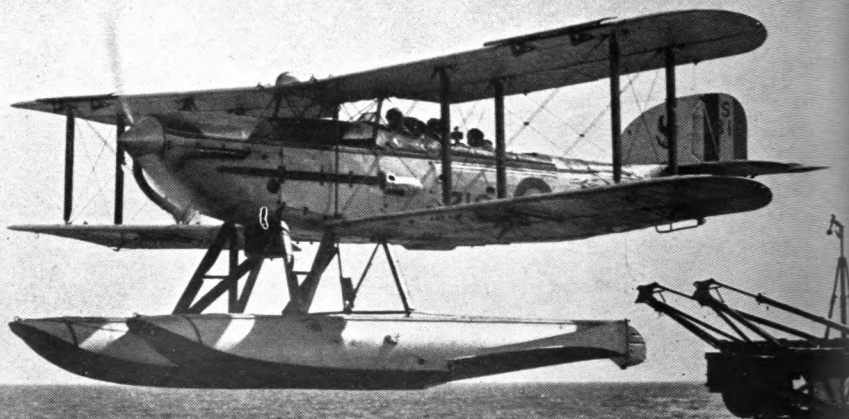
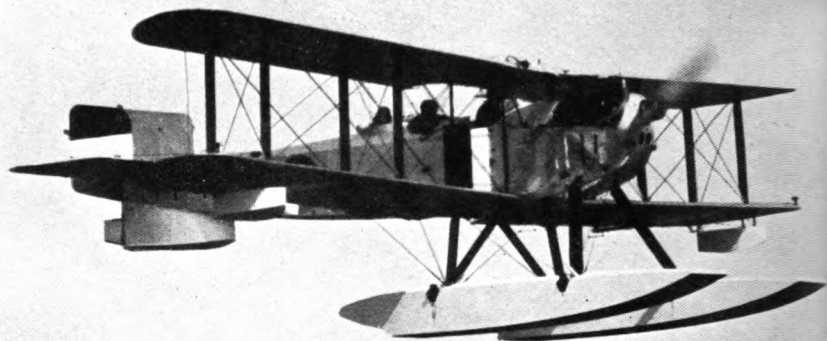
We sent, quite early in the war, a formation of Blenheims to try to bomb the German Fleet lying off Brunsbüttel, at the south end of the Kiel Canal, where they had been located day by day before war was declared by a certain retired R.A.F. officer and his private aeroplane; a feat which even now must not be discussed in detail. I hope to be able to give him full credit for his enterprise and nerve at some future date when the ideas of those in high places about who should and who should not receive publicity have changed, or their taboos no longer operate.

One of these raids was disastrous. Some of the Blenheim pilots in their anxiety to get their target, flew too low, and a German photograph, which was widely circulated in America, shows one of our Blenheims apparently flat on its stomach on the deck of a ship where it had landed after being blown up by the bombs of the next Blenheim ahead. It may even have been disabled by one of its own bombs, if it went off too soon, and if the machines were loaded with contact bombs instead of armour-piercers, which should go through a deck and burst inside the ship. It was definitely a bad start.

After that we began a series of what were called 'Security Patrols' over and around the Heligoland Bight, to stop shipping from going in or out. A big formation of Wellingtons suffered badly on one of these patrols. The Germans claimed to have shot down some fantastic number, thirty-five or forty-five, which was considerably more than the number of machines in the formation. Our communiqué said that twelve (I think that was the number) of our machines were 'unaccounted for'. All who were in touch with the R.A.F. knew that the number lost was bigger, so the assumption was that machines which had been seen to make forced landings in enemy territory or were seen to be shot down, were reckoned as accounted for.

Plate 7. Bristol Beaufighter and Bristol Beaufort.





Bomber Strength in 1939

Behind the scenes was a great deal of agitation and criticism about that communiqué. Such disingenuousness does not appeal to the ordinary British officer, any more than to his men.

Anyhow, such a thing never happened again. And our communiqués have been conscientiously accurate, even though their wording may be weak and the material which they publish neither does justice to the deeds they record nor describes them adequately.

A little later a small formation of Hampden bombers went into the Bight and wirelessly that enemy aircraft were about to attack them. Nothing more was heard of or from that formation.

Such affairs as these diminished our stock of trained bomber pilots, and Bomber Command had to draw on Coastal Command for more men who could fly. And that put more strain on the convoy pilots.

Then there was the raid on the German Naval Air Service Station at Sylt, which, although it was on dry land, was reckoned as a Naval operation and was not held to be a breach of the silent or secret agreement.

The Germans answered our claim to have done much damage at Sylt by taking a party of neutral journalists (there were several neutral nations in those days) to the Island of Sylt across a viaduct which was supposed to have been destroyed and showing them that little damage had been done. Actually our people had done a lot of damage to a small seaplane station at the extreme tip of the island to which the foreign journalists were not taken.

I mention these unfortunate incidents because, in the first place, I am a firm believer in the old horse-racing proverb, 'A slow starter is a strong finisher', and because although we had a quantity of bombers we had not enough crews trained for big

Plate 8. Naval planes: Fairey III D, Fairey III F, Fairey Albacore, and Blackburn Skua

Bombing in This War

operations, and, as we discovered quickly, our bombers were quite inadequately armed for self-defence.

The Germans on their side for a long time respected the quaint understanding that they were not to bomb this country. We used to hear about bombers driven off the north of Scotland, but I rather doubt whether the machines which were met so far north carried bombs in any quantity. They used to go scouting up to the Shetlands and the Orkneys trying to find the British Fleet, probably with the idea that if they did so the *Luftwaffe* would send out an enormous bombing force to blitz it.

But we used to have fighter squadrons far up in the North and along the East Coast, with the result that every now and then our people did shoot down a Dornier flying-boat or a Heinkel bomber.

The first fight in those days between bombers and fighters was when several, probably a dozen, Heinkel and Dornier bomber-fighters went into the Firth of Forth to attack the ships which lay along by the Forth Bridge.

That was one of the oddest raids ever made. The Germans flew right over Edinburgh and Leith and never dropped a bomb. The whole thing would have been funny but that one German bomber machine-gunned the deck of a destroyer on which all the officers and most of the men were standing watching the fighting up above. Several officers and men were killed.

One of the Germans was shot down miles away from the Forth on the top of the Lammermuir Hills by a Glasgow lawyer, a squadron-leader of a Glasgow auxiliary squadron, in a Gladiator. The story says that when the German officer-pilot was told how he had been brought down he said that to have been shot down by an obsolete biplane was bad enough, but to have been shot down by a lawyer was more than he could bear.

That same Glasgow lawyer was one of the finest squadron-leaders the R.A.F. had. And his death was an irreparable loss to the whole R.A.F.

An unhappy witness of the fight was a pupil from the Elemen-

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tary Flying School at Perth who had flown over to Edinburgh to salute his family in a Moth. He found himself in the middle of the battle and left hurriedly.

A Scottish legend says that the first bomb dropped on British soil by a German aircraft was dropped at a flying-boat on the water of one of the far northern islands. It missed the water, hit a hillside, and killed a rabbit.

THE COASTAL COMMAND AT WORK

The German bombers were then doing their best to destroy our convoys which were proceeding up and down the English Channel and/or along the North Sea coast. Escorts of the little Avro Ansons were provided by the Coastal Command, under Air Chief Marshal Sir Frederick Bowhill, K.C.B., C.M.G., D.S.O. They were armed with one machine-gun forward and one other on a swivel inside a transparent cupola on the back of the machine.

During the very early part of the war, and in fact right through the winter of 1939-40, the Anson did magnificent work protecting convoys against mines and against submarines. When an observer saw a mine he signalled to the destroyer escort, which came along and blew it up. If he saw a submarine he dropped a bomb on it, if he were lucky, and at the same time indicated the position to the destroyers, which came along and dropped depth-charges.

But when the German bomber-reconnaissance machines appeared, carrying a couple of machine-guns forward and guns above and below, the poor little Ansons were outclassed. Nevertheless, they always put up a good fight and occasionally shot down their bigger adversaries. And, at any rate, they did divert them from their proper job of bombing the ships in the convoys.

There is one story of the Anson which deserves to go down in history. Three of them were out over the North Sea, from one

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of the Coastal Command Stations in Norfolk. Darkness was coming on, and heavy snow began to fall. Two of them got back to their station but the third, which was farther north, was lost in the snow and the pilot wirelessed for position. His own station gave it to him as Flamborough Head, not knowing whether he was likely to run into the Head, or whether he was high enough up to clear it, and gave him up for lost, with cliffs in front, a raging sea below, snow all round, and darkness falling.

The Group Captain commanding the station, wanting to give the pilot a chance, telephoned to a station near Flamborough asking them to keep their lights on in case the pilot found it.

Half an hour afterwards the Anson pilot telephoned to report that he had landed. The Group Captain rushed to the telephone and asked the lad how he had done it. He replied that he had caught a glimpse of the Head through the snow and picked up a road which he knew, and had followed it down to the station.

Wanting to know what sort of visibility the pilot had found, to help him through the snow the G.C. asked, 'Did you spot the railway?' to which the pilot replied, 'Oh, yes, sir. But fortunately the level-crossing gates were open!'

That shows well the spirit of the Anson crews.

As the German bombing of the convoys became worse in the spring the Coastal Command indented for some fighter squadrons from Fighter Command to work from their aerodromes, and go out and drive away the German bombers when the Ansons signalled for them. That worked well and it gave variety to the Coastal Command stations, which had hitherto been accustomed to Ansons only, and an occasional Hudson.

By this time there were many Hudsons; they were a great deal faster than the Ansons, and they had a two-gun turret aft, besides having two guns in front, which made them quite nasty machines to tackle. But the Germans discovered that because

Bomber Strength in 1939

the gun-turret had to be far aft to allow the crew to use the door, the line of fire of the guns was blanketed by a fin and tail on each side, which left a considerable blind spot through which the gunner could not fire. So the German fighters when attacking a Lockheed used so to manœuvre that the turret was masked by one or other of the fins and rudders. That gave much trouble at first, and wasted a lot of time because they had to dodge about, or 'take evasive action', as the R.A.F. calls it, when the gunner would much sooner have had a steady platform from which to shoot the enemy.

Some crews, by constant training between pilot and gunner, worked out a scheme to throw the blind spot open when necessary. Nothing could have been simpler. The gunner simply said 'Port' or 'Starboard' or 'Right' or 'Left', or 'Red' or 'Green', on the inter-communication telephones, as he wanted the right or left blind spot uncovered.

But an ingenious young officer found a simpler way than that, which was to poke a gun out of a side window of the cabin so that it could fire underneath the tail plane and so underneath the rudder and fin on either side. Consequently the first German who, after this simple device was fitted, came capering up in the blind spot of a Lockheed, got a burst of machine-gun fire from underneath the blind spot, which quite put him off his stroke. After that the German fighters were very wary of the Lockheeds.

Also at first the work of the Coastal Command consisted almost entirely of patrolling the North Sea and the Channel. German submarines operated round the Irish Coast and in the Irish Channel in quantities, so Coastal Command was sent to look for them, and had a fair amount of success. At any rate they kept the German submarines under water, so they could neither travel fast nor see anything.

Coastal Command had a number of big four-motor Short Sunderland flying boats and Saunders-Roe Lerwicks. These worked from the West of England, and Wales, and Scotland,

Bombing in This War

and Northern Ireland, quite far out into the Atlantic, where they did good work of all sorts.

At one time a Sunderland would be bombing or depth-charging a submarine. At another it would be rescuing the crew of a ship which a submarine had torpedoed. The fire-power of a Sunderland is considerable. It had two .303 machine-guns forward and could have had more if needed, it had guns in sponsons amidships, and four guns in a tail-turret. And it also had a gun or two on each side, which were fired from positions inside the boat just under the trailing edges of the wings. So the Sunderland could put up a lot of fire-power when it liked. And in these days of .5-inch machine-guns, and heavy shell-guns it probably has much more.

On the East Coast there were few if any flying-boats until one got as far up as Scotland, because of the ease with which the German bombers could reach their bases. Consequently to attack the German shipping, especially those bringing iron ore from Narvik, Coastal Command borrowed squadrons of big bombers, mostly Wellingtons, from Bomber Command. These were stationed on Coastal Command aerodromes and added considerably to the scenery.

Later on, as I will explain, Coastal Command also borrowed Fairey Swordfish from the Royal Naval Air Service, generally called the Fleet Air Arm, to lay mines, when the Germans attacked Norway. But until that happened in May 1940, Coastal Command was content to keep its flying-boats in the west, and did its North Sea work with its curious assortment of little Ansons, medium-sized Lockheed Hudsons, big Wellingtons, and a flight, or sometimes a squadron, of Hurricanes to attack bombers.

There let us leave the Coastal Command for the time being and consider what the Bomber Command proper was doing.

CHAPTER 15

Big Bombers in France



As soon as they could after war was declared, ten squadrons of R.A.F. light and medium bombers and two fighter squadrons went to France under Air Vice-Marshal P. H. L. Playfair, C.B., C.V.O., M.C., who when war broke out had been commanding No. 1 Bomber Group at Addiscombe. This force, whose H.Q. was at Reims, was known as the Advanced Air Striking Force, or A.A.S.F. Unfortunately it had little chance of striking anything, as this history will show. The machines were Blenheims and lots of Fairey Battles. The heavy Whitleys and Wellingtons remained in England under the A.O.C.-in-C. Bomber Command.

At the same time a force called the Air Component, British Expeditionary Force, went to France under Air Marshal A. S. Barratt, C.B., C.M.G., M.C., who before going to France was Commandant of the R.A.F. Staff College at Andover. It was intended solely for Army Co-operation duty, and was equipped with Hurricane fighters and Westland Lysanders, which the Army Command hoped would be effective for short reconnaissance, contact with troops on the ground, photographic work, ground strafing, and short-range bombing. Later the two were joined as the R.A.F. in France, under Air-Marshal Barratt as A.O.C.-in-C.

The work of the Co-operation squadrons is outside the scope of this book. But I may say that although the Lysander is an excellent aeroplane it is not either armoured or armed for

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ground strafing or for low-level contact bombing. It is an excellent machine for colonial war, but not for all-in war in the modern style. At any rate it was not in its original form as it went into war.

As the Army was not doing much, except building for itself positions in depth, which were left behind as soon as the Army moved up north into Belgium, there was little for the Army Co-operation people to do except take photographs of Belgium, and the country south of the frontier in which the British Army expected to fight, and to go scouting over the Siegfried Positions, or West Wall, as the Germans called it.

BOMPHLETEERING

The uses to which the big bombers in England were put were still more ludicrous. Instead of bombing the enemy positions, including the enemy's Grand Headquarters at Wiesbaden, only a few miles on the other side of the Rhine, the big Whitleys were sent night after night in all kinds of weather to drop pamphlets, or bomphlets, as Mr. A. P. Herbert, M.P., called them, on German cities.

The obvious assumption is that this bomphleteering, as it came to be called, was instigated by the politicians who were in power at that time. I think that there is no doubt that at that time the politicians on both sides thought that those on the other side were ready to give in. At any rate they were afraid to start all-in bombing.

Perhaps I may again mention, although the saying has been quoted so often elsewhere, that Major Alford Williams, commonly known as Al, the best-informed writer on air affairs in the United States, remarked at this time that there was no bombing because the politicians on all sides knew that if it once started it would put them in the firing line 'in both senses'. At the time of writing Monsieur Laval seems to be the only politician who has thus suffered for letting his country down.

Big Bombers in France

For some reason best known to themselves our politicians refused to allow the publication of the contents of their bomphlets in this country. One can hardly imagine that anything which they thought ought to be said to the enemy people at such vast cost of men and machines could do harm in this country. But when, after a while, some of these leaflets came into the hands of the British Press and were published, intelligent people agreed that the reason why they were not published was that the composers were ashamed of them.

Certainly I have never seen anything less likely to convince either an intelligent human being, a sentimental patriot, or a complete nit-wit of the error of his ways in trying to defend a country whose defence has for most of his life been an article of simple faith. Whether one sings *Rule Britannia* or *Deutschland Uber Alles* or *The Starspangled Banner*, the underlying idea is the same to the simple and unsophisticated and patriotic indigenous inhabitant. It is embodied in the late great Theodore Roosevelt's saying, 'My country, right or wrong.'

The only possible good that was done by those bomphleteering trips was that the pilots and navigators of the machines had some quite good practice in instrument-flying and in finding German towns, and, when by luck they struck a good night, of getting to know what the towns looked like in the moonlight.

Apart from that the bomphleteering raids were a waste of good petrol and wear and tear of the machines, when nothing happened, or waste of valuable lives and of some £20,000 worth of aeroplane, when, as happened sometimes, machines crashed with all hands.

That period of the war produced some good stories, but I think that two of the best are these.

One of the bomphleteers came back early from his trip and when asked why he was so quick he said that he hadn't bothered to unpack the parcels of bomphlets but had just pushed them out through the hatch unopened. Horrified, the Commanding

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Officer said to him, 'Good Heavens, man, you shouldn't have done that, you might have hurt somebody down below.'

The other was of a pilot who came back late from his trip and when asked by his Commanding Officer for an explanation, said, 'Well, sir, I'm sorry, but I wanted to make sure of the job, so I landed and went round and pushed the pamphlets under the doors.'

Which shows how little seriously the pilots themselves took this bomphleteering. The author of the silly idea has managed to hide his identity.

But there is another story, and quite authentic, which turned out to be funny but might have been a wholesale tragedy.

One of the Whitleys took off in fog, ran into clouds, flew for hours in the dark and saw nothing, and began to ice up. So the pilot turned and headed for home.

After a few more hours of seeing nothing although daylight was coming on, the navigator told the pilot that he could not tell him where he was other than that he was outside of Germany and presumably somewhere over France.

The pilot let the ship down gently through clouds peering for something that looked like land. They got down to 2,000 feet and the pilot knew that if he came any lower he might hit the top of the Vosges, or the steeple of a church on a lower hill. So when the navigator assured him that they were at any rate over French territory he gave the order to bail out.

One of the crew, who told my friend the story, said that he came out of the clouds at about 500 feet and made a good landing. But a bump on the head knocked him out for a minute or two. When he came to he found himself in a kind of creamy light and thought in a dull way that he must be in Heaven, though it seemed a rather cold Heaven. This I may say was some time in the winter of 1939. Then he found that the golden glow was merely the light trying to get through his parachute, which had settled down on top of him because the air was a flat calm.

Big Bombers in France

When he had untangled himself he saw another member of the crew some few hundred yards away. So he collected him and they hunted round and found the captain of the ship in the next field. But nowhere could they find any sign of the aeroplane itself or of the tail-gunner. So they walked on until they came to a road, and they walked down the road until they came to a village, and in the village they found an estaminet. There they started drinking mulled wine to warm themselves, and to the soul of their poor friend the tail-gunner. They were just warming up and becoming sentimental over his memory when the door opened and in he walked. They fell upon him and ordered him to explain why he was alive.

He said that he got the order to bail out all right on the inter-communication telephone and answered it, but whether the office window was frozen tight, or he was so frozen stiff that he had not enough energy to burst it open, he did not know. Anyhow he said that he was so cold that he did not care whether he crashed with the machine or with his parachute. So he sat where he was.

Presently there was a terrific crash, the office burst wide open, and he found himself on the ground. And he ended his story by saying, 'It certainly wasn't quite so cold on the ground as it was high up, but, all the same, if the machine hadn't caught fire I should have been frozen to death.'

IT'S AN ILL WIND

How many men and machines we lost in such foolish ways during the period which was jestingly called the 'Sitzkrieg' nobody can know outside a select few at the Air Ministry. And I doubt much whether the people who paid by the loss of their sons and brothers and husbands will ever be told.

No wonder the Americans called it a phoney war.

All the same, we in England have reason to be grateful to the German High Command for not striking sooner. They gave us

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almost nine months of uninterrupted labour in which to build up our stock of aeroplanes and to increase the size and manpower of our aircraft factories. They gave us that extra time to overhaul our imbecile training system and to train more people as pilots and air crews and mechanics.

They gave us time to organize in Canada that vast British Commonwealth Air Training Plan, to give it the full official title, which has already supplied us with thousands of first-class pilots and air crews from all over the Empire and will supply us with tens of thousands a year while the war goes on.

Also those nine months allowed us to lay out new aerodromes and equip them so that we could form new squadrons as soon as the supply of aircraft grew. If only the Germans had started their Blitzkrieg in September 1939 instead of letting it go in May 1940, there might have been a very different story to tell now.

CHAPTER 16

The War Begins



One might justifiably say that war began on the 9th of April 1940, for on that day German troops occupied Denmark without resistance, and their air-borne and sea-borne troops occupied the key positions in southern Norway. On the same day Air Marshal Charles F. A. Portal, D.S.O., M.C., was appointed Air Officer Commanding-in-Chief Bomber Command, to succeed Air Chief Marshal Ludlow-Hewitt.

The affairs which led up to the outbreak are worth recalling. One night in March H.M.S. *Cossack*, a destroyer, went into a Norwegian fiord and cut out from a German steamer, the *Altmark*, which was being used as a prison-ship, a number of merchant seamen who had been taken off various British ships which had been sunk out on the oceans by German sea-raiders.

On April 1st the Norwegian Government protested against this trespassing in Norwegian territorial waters. On April 8th the Allied Navies—France was then our ally—helped by the Bomber and Coastal Command of the Royal Air Force and by the Fleet Air Arm, laid mines in Norwegian waters to prevent German ships from carrying iron ore down the coast of Norway inside territorial waters. And on April 9th the German invasion began.

That is in itself understandable. During the war between Finland and Russia during the winter of 1939–40, Great Britain and France had got ready an expeditionary force, officially

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stated to be 150,000 men, which was to have travelled through Norway and Sweden to help Finland. That would have placed Sweden's two longitudinal railways and Sweden's air ports in the hands of the Allies, who would then have held a commanding position along the Swedish coast of the Baltic within easy bombing distance of the seaports, shipyards, and aircraft factories on the German side of the Baltic.

Whether the Allies would have used such positions for such a purpose it is impossible to discuss, but, as I said elsewhere at the time, any professional soldier or airman considering war in the abstract would agree that any power which could get such a position would be foolish to waste the opportunity.

The fact that such an expedition had been organized, and the affair of the *Altmark*, was obviously a good enough excuse for arguing that, with or without the consent of the Scandinavians, the Allies were going to invade Norway. And the Germans got there first. The pity is that we were not a month quicker.

At once, but twenty-four hours too late, the British Navy attacked German naval forces wherever they could be found, and the Coastal Command and the Bomber Command and the Royal Naval Air Service attacked German bases in Norway, and laid mines in the Baltic.

BALTIC MINE-LAYING

That mine-laying, which may justifiably come under the heading of bombing, was an exhibition of the coldest courage that I have ever seen. Napoleon Bonaparte, I think, rated 'three o'clock in the morning courage' as the highest of all. This was all-night courage.

I was staying at an aerodrome on the East Coast at the time. The R.N.A.S. were using the old single-engined Fairey Swordfish torpedo-bomber biplane, with a 775 h.p. Bristol Pegasus. Its best speed when new on floats is not more than 120 m.p.h., so these old machines which had to flap about with a mine and

The War Begins

an auxiliary petrol tank, cannot have been flown at more than 90 m.p.h. at the most.

The mine was strung up in the undercarriage where the torpedo generally goes. But instead of a nicely streamlined torpedo the mine was a flat-ended cylinder of the very worst aerodynamic shape. To make matters worse, the navigator-observer, who should sit in the middle seat behind the pilot, was moved to the aft gunner's seat and in between him and the pilot was a vast cylindrical petrol tank which stuck up high above the fuselage and projected over the navigator's knees. A bullet in the aft end of the tank would have drowned the unfortunate navigator-observer-gunner in petrol.

They went off at night when the rest of us were going to bed and they came back when we were still in bed. And yet they used to appear in the afternoon, before *their* breakfast, looking cheerful and fit to do it all over again. Their losses were astonishingly small, which is a high tribute to the aeroplane and its engine and to their navigation.

Victoria Crosses are not given for acts of gallantry done under orders. And, incidentally, they are supposed to be given for saving somebody else's life or for a gallant and useful act at the risk of losing one's own life. I have been told that the betting is supposed to be 10 to 1 against survival to make an action worth a V.C. One of the peculiarities of this war is that the Authorities seem to give Victoria Crosses to men for saving their own lives. These Naval aviators were acting under orders, therefore they were not eligible for V.C.s. But no Victoria Cross has ever been won for any act of greater cool and sustained courage. They should certainly all have been made Companions of the Distinguished Service Order.

THE WAR IN NORWAY

Lockheed Hudsons, which started by being twelve-passenger air-liners and had been brought into the R.A.F. as training

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machines to convert single-engine pilots into twin-engine pilots, and also for the training of navigation crews, suddenly became bomber-fighters. And Blenheim bombers, which were intended only to carry defensive guns, became long-range fighters. Consequently one had Lockheed air-liners bombing Norwegian aerodromes protected by Blenheim bombers which carried no bombs.

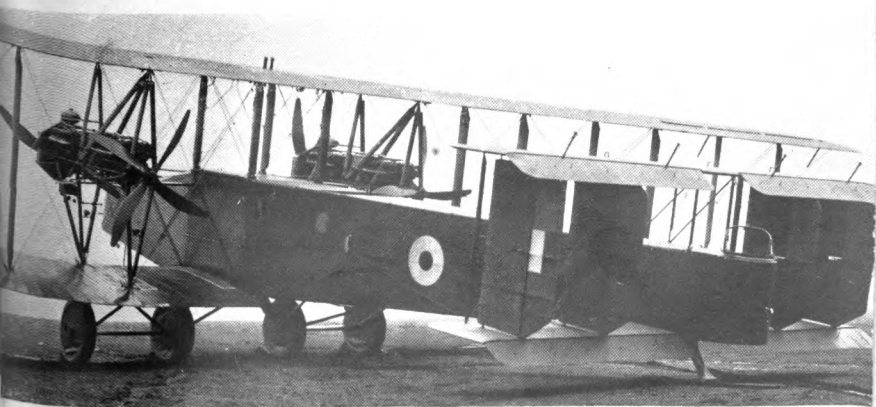
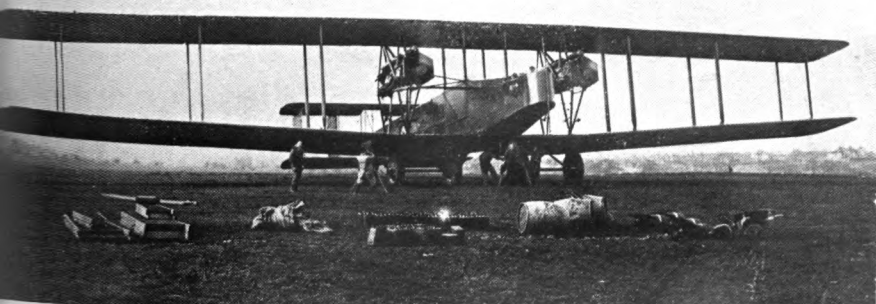
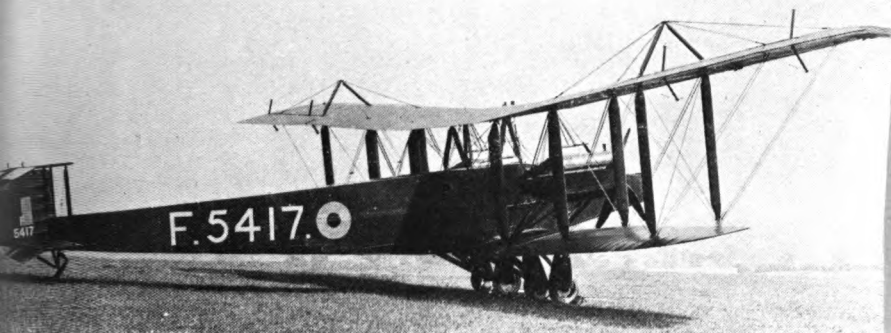
Nevertheless, as the Blenheim was originally intended to be a bomber I may be justified in telling of one of the most amusing incidents of that part of the war.

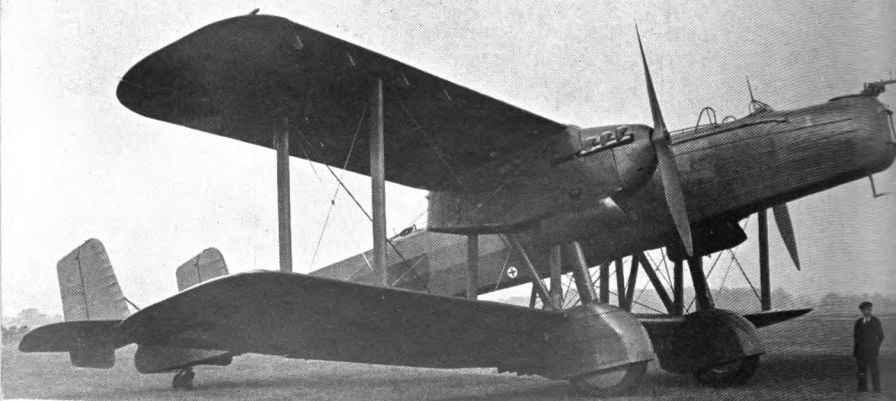
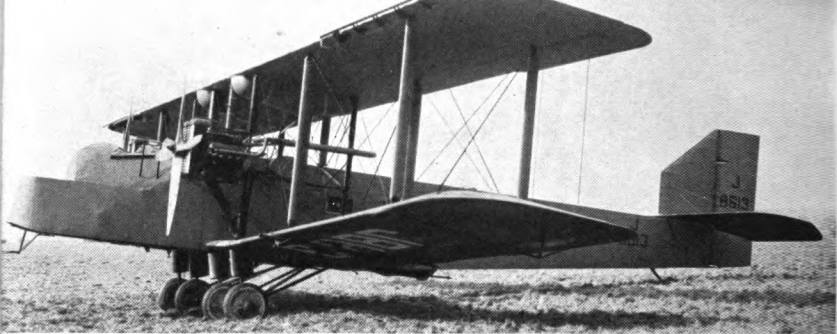
Two Blenheims, armed as fighters, were sent to the Norwegian coast, to be at a given point at a given time and join up with a formation of bombers which they were to protect while the bombers did their work. The Blenheims arrived on time and the bombers were a quarter of an hour late. A radio signal was sent in code to the leader of the two Blenheims telling them to wait for the bombers. Although his radio man had the necessary de-coding apparatus, he signalled back, 'Message not understood'.

We may assume that thereafter he had a chat on his short-wave radio with his companion, for the two of them sailed in and attacked Stavanger aerodrome. They found a lot of German machines lined up being inspected, or overhauled or refuelled. And they set a lot of them alight. They took the Germans by surprise, and before the aerodrome guns could get onto them they had shot away up a hill-side round the corner of the hill and disappeared.

The Germans apparently said their equivalent for, 'So that's that', and returned to the machines, trying to put out the fires and get the repairs under way. They had hardly settled down to it before the two Blenheims came back again and let them have it a second time, and set more machines alight. This time the

Plate 9. Handley Page ancestors: the O/400; the V/1500; and the tail gun-pit of the V/1500.





The War Begins

gunners were more ready, but failed to hit them, and again they dodged round the hill, and went home.

This time the Germans apparently said the equivalent of, 'So that really is that', and had just started work again when the belated bomber formation turned up and plastered the place thoroughly.

I may say that when the whole story came out nobody investigated too closely the explanation of the 'not-understood' signal.

BOMBERS VERSUS NOTHING

There is nothing much that one can say about the progress of that lamentable Norwegian campaign. Our bombers did their best by hammering the harbours and aerodromes which the Germans had occupied. We hoped to hinder the movement of German troops and aircraft so as to save our unfortunate Expeditionary Force up in the north.

German bombers which had nothing up against them concentrated on hammering our troops in the valleys and in the harbours at which they were trying to debark and later to embark troops. We had no aerodromes from which short-range fighters could operate against the German bombers. The Navy's aircraft-carriers brought a squadron of Gladiators near the Norwegian coast and the Gladiator pilots who had never flown off a deck gallantly took off and landed on a frozen lake, which they hoped to use as an aerodrome.

The Germans naturally bombed the lake, much as Napoleon Bonaparte in his campaign against Russia had the ice of a lake which the beaten Russian Army was crossing smashed by turning his guns onto it. The last of our Gladiators took off the lake when the water was already covering his wheels. He fought until his petrol and ammunition were done and then crashed in a

Plate 10. Handley Page successors: the Hyderabad, Hinaidi, Heyford, and Harrow

Bombing in This War

told me of a Minister who, praying for members of his congregation, said, 'And let us pray for the five hundred people who have been killed in the air raid, according to official announcements—of whom five thousand lived in this parish.'

PARACHUTE TACTICS

What is more important is that such striking results were got by using parachute troops. The Germans had used parachute troops largely in occupying the aerodromes in Norway. And they had tried them in attempts to get behind our troops up in the north. But so many were drifted by the wind up against mountain sides and were killed or maimed that there was not much done in that way.

Holland was designed by Nature for parachute troops. Nearly all of the country is flat. Although there is plenty of wood, there are no large forests. And in any case the parachutists were mostly dropped from very low down, practically onto the gun-positions round the peripheries of the aerodromes.

The newspaper stories of parachutists coming down disguised as nuns or rate-collectors or parsons or Dutch doctors festooned with folding bicycles, radio sets, Tommy guns, and other ironmongery have since proved to be the nonsense which people in aviation thought they were when published.

The tactics in capturing an aerodrome were much the same as those used in attacking trenches in Spain, and later in Crete. First of all the fighters came down and machine-gunned the defensive gun positions to put the defenders underground. Then the dive-bombers went round the same course to do as much damage as they could and to make sure that the people stayed underground in fear of more bombs. Then, and this is where the tactics differed from those in Spain, the parachutists were dropped practically on top of the gun positions so that when the gunners came out of their dug-outs they found themselves facing the Tommy guns of the parachutists. In Spain

The Attack on the Lowlands

when they came out they found themselves facing the bayonets of the infantry, who had crept up while the bombing was going on.

In this way the cities of western Holland were captured practically within twenty-four hours, and the Netherlands Army up along the frontier had no bases whence they could draw supplies, and no homes to which they could retire. So we may safely say that the bombers held up Holland, and the German Army had only to occupy it.

THE BATTLES OVER BELGIUM

The attack on Belgium took a rather different form. The much-advertised Maginot Line did what it was expected to do, it stopped a frontal attack, or rather the Germans were not such fools as to attack in front. All they did was to walk round it.

Soldiers of experience now hold that if instead of going up into Belgium in the hope of stopping the German advance, the British Expeditionary Force had held its own open lines of defence from the sea at Nieuport to the northern end of the Maginot Line, there might have been a chance of stopping the German advance.

Unfortunately the Army did move up to Belgium. And there are soldiers who would still like to know why that move was made. They have an uncomfortable feeling that a joint meeting of French and British politicians in France insisted that the soldiers should take that line of strategy.

Anyhow, the lamentable result is well known. By the time the British and French troops had got up into Belgium the Germans were already advancing through that country. And to make matters worse a big thrust by German tanks through what had been considered the impossible Ardennes Forest broke through the point near Sedan, north of the Maginot Line, which formed the hinge on which the British Army had done its unfortunate right wheel.

Bombing in This War

There again the German Stuka bombers laid a flying barrage in front of the advancing tank formations. And there was nothing to stop them. They easily overwhelmed the French infantry, armoured cars, and cavalry. Virtually the French had no Air Force. And the big force of French tanks which might have been useful was parked away behind the Maginot Line. The cause of defeat was not treachery: it was just stupidity, as in 1870.

Our Advanced Air Striking Force did its best in impossible conditions. The German advance north of the Maginot Line—the ‘Battle of the Bulge’, as Mr. Winston Churchill called it—drove right across the country which had been occupied by the Royal Air Force. So the ground personnel could only heave their kit and tools onto their trucks and get out.

THE UNFORTUNATE BATTLES

The Fairey Battles, which were supposed to be light bombers to attack enemy positions in trenches, had to work as dive-bombers—a type of aeroplane which did not exist in the Royal Air Force because we had never recognized that for proper Army co-operation aeroplanes of special types for dive-bombing and ground-strafting are necessary, and that the personnel must be trained *with the Army for the Army by the Army*.

Consequently the losses among the Battles were terribly high. No. 12 squadron of Battles achieved fame on May 12th by a gallant effort to destroy the big bridge at Maastricht which ought to have been blown up either by the Dutch or by the Belgians, or by the French or by the British, before the Germans reached it.

The squadron was asked to provide twelve machines with pilots and gunners to destroy the bridge. Every man of the flying personnel stepped forward to volunteer. Lots were drawn. Twelve machines were sent. Only one pilot came back and he had a dead gunner. Fortunately, all the other twenty-two were

The Attack on the Lowlands

not killed. Some of them are prisoners in Germany. Two posthumous V.C.s were given.

In the early stages the Battle squadrons were used for night-bombing, a job for which they were quite unfit. Their losses were so high that they were turned onto day-bombing. Then their losses became heavier still and they were put back on night-bombing. Mr. Charles Gardner of the B.B.C. in his book, *The Advanced Air Striking Force*, says that their day losses were 19 per cent and their night losses 1·07 per cent.

On May 23rd General Gamelin, Commanding-in-Chief the Allied Forces in France, was superseded by the French Cabinet in which M. Reynaud succeeded M. Daladier as Minister of Defence.

General Weygand, who had been Chief of Staff to General Foch in 1918 and had later by his organizing ability enabled the Poles to drive the Red Russian Army back from Warsaw, was recalled from Syria and made Commander-in-Chief of the French Army. He flew from Syria to France and immediately flew across the advancing German Army to meet General Lord Gort and the French and Belgian commanders in Flanders. After which he again flew across the enemy's armies back to his own Headquarters. And this time what was known as the Schlieffen Plan, which had been worked out before the War 1914-18, to capture the Channel Ports by a thrust straight across northern France, succeeded.

Everything we had in this country in the way of light and medium bombers was sent over to France to do what amounted to Army co-operation in the hope of saving the flying French Army, and as much as possible of the British Expeditionary Force and the Belgians and French who were surrounded in Flanders.

When they might have been bombing German aircraft factories and so preventing the growth of the German Air Force for its attacks on this country we had to throw away men and machines bombing railways and roads, bridges and oil-stores

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and ammunition dumps, behind and in among the German Army advancing in France.

For historical reference I may mention here that by May 26th the Germans had occupied Boulogne. On the same date General Sir Edmund Ironside, Chief of the Imperial General Staff, was appointed Commander-in-Chief of the Home Forces. The appointment was, if not a step backwards, at any rate a step sideways.

General Sir John Dill was appointed Chief of the Imperial General Staff, and fifteen French generals were relieved of their commands.

THE DUNKERQUE AFFAIR

The fact then became evident that the great task before all three Services was to get out of Belgium as many as possible of the 400,000 men who were in it. The most optimistic hardly dared to think that we should get 40,000 out.

This book is concerned only with bombers, so this is no place to describe even briefly what happened in Flanders when No. 11 Fighter Group, under Air Vice-Marshal K. R. Park, from the south-eastern counties was let loose on the German Air Force, which was dive-bombing and high-bombing our retreating troops.

Naturally a certain number of bombers got through these screens of fighters. As the fighting was done high up and away back in Belgium, naturally our troops lying on the beaches waiting to be taken off by the Navy and its fleet of odd auxiliaries got the idea that the Air Force was doing nothing. Many were disheartened by the notion and there was nobody there to tell them anything else. But those who were in the air and know of the astonishing German losses got some idea of what the fate of our troops at Dunkerque would have been but for the fighters of the R.A.F.

The Attack on the Lowlands

A METEOROLOGICAL MIRACLE

The crowning mercy vouchsafed to the British Army was that we had a week of flat calm in which our assorted watermen were able to get the troops off the beaches in anything that would float, and that when our last men were being taken off and the German artillery had come within range of the sea we had two days of fog to spoil the German shooting. As a meteorological miracle it was equal to that other extreme, the gale which shattered the Spanish Armada. Actually we got 335,000 men out of Dunkerque.

On May 28th Leopold, King of the Belgians, ordered his Army to lay down their arms. He was much criticized at the time and abused in the English Press as a traitor. Our writers forgot that he was King of the Belgians and that as such his duty was to do the best that he could for his own people.

Had he kept his little Army fighting as a rearguard to protect our embarkation it might have helped us but it would have meant a huge sacrifice of Belgian lives. King Leopold retired as a prisoner of war to his Palace at Laeken. His action has been justified by Admiral Sir Roger Keyes, R.N., who was on the King's personal staff, and by Mr. Cudahy, the U.S. Ambassador in Belgium.

Our troops started embarking at Dunkerque on May 29th or 30th and by June 4th the last of them had arrived in England.

Similarly, for purposes of historical reference I may record that on June 14th the German Army entered Paris. On the 16th M. Reynaud resigned and Marshal Pétain, who had commanded all the French Armies at the time of the Armistice, 1918, was made Prime Minister. The French Government had by that time retreated to Bordeaux.

Bombing in This War

ITALY HAS A TASTE OF BOMBING

In the meantime, on June 10th, Signor Mussolini on behalf of the Italian nation declared war on 'the plutocratic and reactionary democracies in the west'. The first action of the R.A.F. after this declaration of war was to send a squadron of Wellingtons to the south of France and to bomb the Fiat factory at Turin—just a taste of things to come.

Unfortunately, as France collapsed a week later, the R.A.F. had to withdraw that squadron and were unable to renew the attack until several months later when bomb raids were made on Turin and Milan starting from England.

An interesting point here is that when war was declared the only bomber which could have made the trip from Turin to London and back, or vice versa, was the Savoia-Marchetti tri-motor.

A minor but interesting point is that the ground staff which had to look after this Wellington squadron were flown to Bordeaux by troop-carriers and were flown back again, after the French collapsed, over France, which was mostly occupied by the Germans, and across the English Channel, over which German fighters and bombers were already beginning to appear.

On June 22nd a French delegation met Herr Hitler and the German Army and Air Staff at Compiègne in the same railway carriage in which General Foch had met the German delegates who came to sign the Armistice in 1918.

The terms were practically an unconditional surrender, which could not be helped because by that time the French had no more organized forces with which to fight.

Officially the fighting in France ceased at 12.35 p.m. on June 25th. And thereafter the R.A.F. was free to fight our own battles.

The Attack on the Lowlands

AN R.A.F. COMMENT

I happened to be in an R.A.F. Mess the night when the surrender of France was announced on the nine o'clock news. Everybody sat round the anteroom and tried to look terribly solemn as the speaker announced the deadly facts.

When his voice had ceased a quiet man in the corner looked over the top of his newspaper and remarked, 'And now we can get on with the war.' Everybody laughed.

I can fairly say that such was the attitude of mind of everybody who knew what had been going on behind the scenes for years. Hardly anybody whom I knew in a responsible position in the R.A.F. did not realize that France, and the French Army and the French Navy and the French Air Force, were going to be a drag on our war effort, even if they did not let us down as they did.

Those of us who remembered the French Air Force of the last war expected something better, but those who were behind the scenes in French politics expected something worse.

There have been and there are many magnificent soldiers in France and there are to-day individual bomber and fighter pilots in the French Air Force who are equal to our best. But neither in training nor equipment nor in general qualities were the bulk of the *Armée de l'Air* nearly up to our standard. When Mr. Churchill, after the French surrender, offered British assistance the French admitted publicly that never again would France be a first-class Power.

I say that because I hope it may help to drive into the minds of my readers the need for this country, call it Britain or England as you please, to rise to still greater heights and make itself the dominant Power in Europe. For centuries we have got along on the 'Balance of Power', which meant that we always allied ourselves with the second strongest nation on the Continent so that we could keep the strongest nation from dominating Europe. Now we have to dominate Europe ourselves. The only possible peace in Europe is the *Pax Britannica*.

CHAPTER 18

Germany versus Britain



When France fell out quite a new phase of the war opened. The German Air Force, relieved of the need of chasing round after the French Army, were able to settle down in July and August to an organized air offensive against Great Britain.

Their first operation was to send masses of dive-bombers with fighter escorts to attack our shipping which was passing through the Straits of Dover. These were beaten off with heavy loss by fighters from No. 11 Group, whose operations extended from the mouth of the Thames right along the South Coast. This was commanded, as already stated, by Air Vice-Marshal K. R. Park, M.C., himself a pilot of the last war.

The next German operation was to attack with big formations of bombers, Heinkel 111's and Dornier 17's and 15's, and at the same time masses of Stuka dive-bombers, which were to attack the coastal towns and aerodromes. These big bomber formations were stepped up one above the other to as high as 25,000 feet.

Much damage was done by these Stuka dive-bombers at certain of the coastal aerodromes, but the casualties among the personnel were surprisingly small. At one coastal aerodrome a bomb blew in the side of a concrete-roofed building in which the Commanding Officer and members of his staff were directing operations. The roof fell on the people inside and killed, I think, seven out of nine. But the rest of the personnel who were

Germany versus Britain

scattered about in trenches and dug-outs suffered hardly any losses.

At another coastal aerodrome, although all the sheds were hit and a lot of machines were set on fire and lost, there were, I was told, when there, only about ten casualties.

A dive-bombing attack was made on Brooklands, which ought to be one of the easiest targets in the world. Some damage was done, and a few people were killed, but output was hardly held up at all.

More damage was done at Croydon, where a number of civilians who were employed re-building damaged aircraft were killed. But in spite of this there was practically no interruption to the output of new aeroplanes or repairs.

By that time we had learned something of the beauties of Dispersal, and practically every workshop, big or little, had subsidiaries dispersed throughout the country.

After a few weeks of this sort of thing Stuka dive-bombers were withdrawn, and the attacking forces consisted of Heinkel and Dornier bombers escorted by Messerschmitt 109 single-seaters and 110 two-seater two-motor fighter-bombers. These also were beaten in daylight in spite of improved armour.

LUFTWAFFE CASUALTIES

The biggest week of the war was that between August 11th and August 17th, when our fighters brought down 214 German fighters and 281 German bombers, a total of 495 machines. Altogether, in the nine weeks from July 8th to September 7th, the R.A.F. destroyed 786 German fighters and 811 German bombers, a total of 1,681 machines.

During that time we lost 461 fighters and 131 bombers, a total of 601 machines, from which 205 fighter-pilots were saved, consequently our loss in fighter-pilots should be given as 152 in the four weeks from August 11th to September 7th, when we started calculating the number of pilots saved by their para-

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chutes, or by putting their machines into the sea and being rescued by speed-boats.

The three greatest days for the R.A.F. were August 15th, when the R.A.F. brought down 180 enemy aircraft; September 15th, when they brought down 188, the record day; and September 27th, when they brought down 133. From this fighting we learned that the Germans had not developed self-defensive bombers to the extent that we had, and our bomber crews knew well how difficult self-defence is, even with Frazer-Nash gun-turrets.

Not all of this fighting was over the southern counties. Bombers made attacks on the east and north-east coast and counties and lost fairly heavily there. One bomber, a Dornier, was brought down over Newmarket by one of the prettiest bits of co-operation between fighters and searchlights that I have seen. The machine came across as if it had flown over Norwich and was picked up quite suddenly by a cone of five searchlights. Almost at once we heard the rattle of the eight machine-guns of one of our fighters, and the machine went down about half-way between Newmarket and Cambridge. I saw it on the road next day. The crew apparently got out by parachute.

CHAPTER 19

Constructive Policy



One thing that puzzled everybody who thought of the subject about this time was why, if the German Air Force was anything like so powerful as it had been cracked up to be, the German High Command did not send over an immense bomber force to smash up our production in the Midlands and North Country industrial areas.

For several years before war began public men of importance in Sheffield, on public occasions such as the dinners of the Aeronautical Inspection Department, had said openly that if one air raid could blot out certain streets, half a dozen of them, in Sheffield, there would be no more steel supply for a year. Those speeches were reported in the Sheffield papers and in the aeronautical papers, in the hopes that the Government of that time might be induced to set up alternative steel-production plants elsewhere, or, to set up shadow factories as they had done already for the Aircraft Industry. But to everybody's surprise the Germans kept on hammering away at the South Coast, evidently trying to break up our fighter stations so that if they tried a landing with an invading force there would be no fighters to stop them.

Apparently each side had misjudged the other. The Germans had under-estimated the strength of our fighters and we had over-estimated the strength of their bombers. During the much-talked-of Battle of Britain practically all the fighting was done

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by squadrons from No. 11 Group. This at times was reinforced by fighters from No. 10 Group, Air Vice-Marshal Sir Quintin Brand, in the West Country, and No. 12 Group, Air Vice-Marshal Leigh-Mallory, north of the Thames, but no call was made on the fighter squadrons in the North which were ready to beat off any mass raids on the northern industrial centres or the Midlands. Nor were the Scottish fighters called upon.

Occasionally if a squadron had done very heavy duty it was sent to one of the other areas to rest and a new squadron was brought down. But the other areas were never depleted. Consequently if the Germans had tried a big air attack on our industrial centres they would have been met there and beaten just as decisively as they were over the Channel.

We on the other hand thought that the Germans had an enormous force of first-line bombers. And somehow the explanation of why that force was not so big as we expected never seemed to strike anybody till after the German conquest of Greece and Crete.

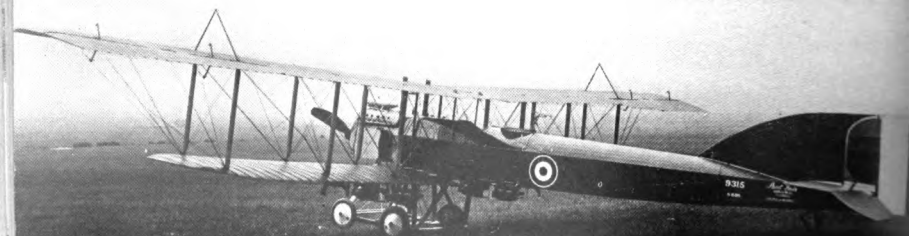
SACRIFICES TO THE ARMY

The fact was that an enormously high proportion of the material and the man-power and factory space which could have been building first-line bombers was used in building the old tri-motor Ju.52, which is a troop-carrier and parachutist-carrier, or the Junkers Stuka 87, which is a two-seat dive-bomber. Both of them are purely Army co-operation bombers. Against a fighter force the old Ju.52 is about as easy a mark as a sitting hen. And the Stuka, when once it has its nose on its target, is as helpless as a hen with its beak on a chalk-line—it just has to stop there till it is pulled off.

The Stuka bomber, as already said, is simply intended to lay

Plate 11. Handley Page's latest: the Halifax, from below and from above





Constructive Policy

a flying barrage in front of tanks and mechanized infantry. The old 52 is just a troop-carrier, with or without parachutists.

Now those two types did efficient, if brutal, work in Poland. The Ju.52 transported troops in masses to Norway and they dropped a certain number of parachutists. They dropped many parachutists over Holland, and some in Belgium and France. Then again they did effective service in Greece. The Stukas hammered our rearguard infantry and they bombed the Greek towns and our air bases.

In Crete the Stukas smashed our gun emplacements at any place where our infantry tried to put up a fight. And the Ju.52's dropped the troops. But neither of them would have had a chance either in Norway or Greece or Crete if our fighters had been able to get at them. We know what our fighters did with the Stukas over Dunkerque and over the Channel. And the Ju.52's would have been still easier targets.

No doubt so long as those particular types of bombers are regarded purely as accessory and auxiliary and ancillary to the Army they are well worth while, and from the German point of view they have undoubtedly paid for themselves. But the fact that so much material and time was spent in building them saved this country from what might have been a very serious bomber attack just at the moment when we most needed to be free of it.

By sacrificing the Luftwaffe thus to the Army the Germans scored heavily on the Continent of Europe, but lost their chance against England.

Accounts of what actually happened in the Russian campaign are still so impossible to verify and so difficult to believe that practically no lessons can be learned from them. But we can at any rate be pretty sure that the dive-bombing screens and parachute-troops have been used largely in Russia on both sides.

*Plate 12. The Short Stirling, head-on and three-quarter views.
Bottom: the Short bomber of 1917*

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THE ORIGIN OF PARACHUTE TROOPS

I said at the beginning of this book that aircraft which carry parachutists can be regarded as bombers, because, after all, a man who is dropped by a parachute is only a more intelligent type of bomb than one that goes 'bang'. If a number of them can be dropped convenient to a mass of inflammable material, such as an oil-dump or an ammunition-dump, they can probably do rather more damage than would the same weight of bombs. Therefore I make no excuse for including parachute-machines in this survey.

There is a common impression that the idea of parachute-troops originated in Russia, that our military people laughed at them, and that the Germans professed to laugh at them but adopted them.

The fact is that the idea was originated by a British officer, Lieut.-Colonel L. V. Stewart Blacker, of Queen Victoria's Own Corps of Guides, now known as the Punjab Frontier Force. Colonel Blacker was one of our earliest aviators. He served many years on the North-West Frontier and used to make a habit of going up into Chinese and Russian Turkestan during his leave to study the conditions there, because we all expected a Russian invasion from that direction. He learned to fly before the last war, served with the Indian Corps in France and with the R.F.C. Also he worked as a specialist in small arms, when the R.F.C. had its Technical H.Q. at De Keyser's Hotel—now Unilever House, Blackfriars. He is now a director of Nash & Thompson Ltd., and of Parnall Aircraft Ltd., the firm which makes Frazer-Nash gun-turrets. He was also the originator of the flight over Everest.

In a book called *Tales from Turkestan* which he published in 1925 under the name of Stor Lob, he described in detail the use of parachute-troops on the Indian Frontier, according to his ideas of how the job should be done. And those are precisely the methods which have been adopted by both the Germans

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and the Russians. That the British Army did not adopt them is not the fault of the Army. It is the fault of the Treasury and of the Government, which, having refused to let us have an adequate Air Force, practically refused to let us have any Army at all.

We do know that we have parachute-troops now and we learned after that affair in Italy, that, like all our other systems, they are better than those of any other nation.

And here I would entreat readers not to use that silly newspaper word 'paratroops'. *Para* means against. A parasol is a guard against the sun. A *parapluie* (French) is a guard against rain. A paratroop would be a machine-gun or barbed wire, or something with which to parry troops. A parachute is a thing to prevent a fall, so how can a man who uses a parachute be a paratroop?

CHAPTER 20

Offence and Defence



Although there is no doubt that the Battle of Britain, as it came to be called, went far towards turning the tide of war, there has been a tendency to over-rate its importance. Therefore we shall do well to consider the views of Air Chief Marshal Sir Robert Brooke-Popham, one of the earliest of our Army aviators and, at the end of the second year of war, Commander-in-Chief of all His Majesty's Forces in the Far East, with Headquarters at Singapore, the key to the Pacific.

Speaking in London on the 28th of August 1940, he said: 'The command of the air cannot be won by a single Battle of Trafalgar as could the command of the sea. Bombers bound for Oxford might be shot down over Surrey by fighters from Kent and the best defence of Derby might be an attack by bombers from Norfolk on Dessau. Fighters are purely defensive, and to win a war an Air Force has to be offensive—that is the job of the bombers.'

He said that he had heard a lot about Spitfire and Hurricane Funds, but why not a Hampden or Stirling Fund? Incidentally this was the first mention of Stirlings in this country, though they had been described and discussed in the United States.

Speaking of the Empire's comprehensive work in the war he remarked that he knew a South African who held a commission in the Royal Air Force and was representing New Zealand in Canada.

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Sir Robert has held all the important posts in the R.A.F. with the exception of that of Chief of the Air Staff, which is curious, because he was the first Commandant of the R.A.F. Staff College and therefore might be supposed to know more about staff work than anybody else. Throughout the War 1914-18 he was in charge of all supply work in France all the way from feeding the troops to co-ordinating the supply of new aeroplanes. In peace-time he commanded in 'Iraq, he organized the Fighter Command, then called the Fighting Area, R.A.F., and he was a Member of the Air Council for Supply and Research, so there is nobody whose opinion on air war is better worth hearing.

Apart from that, in the early part of this war, he went to Canada to investigate the production of aircraft in that Dominion, and also to lay the foundations of the great British Commonwealth Air Training Plan, the B.C.A.T.P., which has developed into one of the most enormous organizations of the war.



THE GERMAN BLITZES

After the Battle of Britain came the series of blitz attacks on London and other cities, Bristol, Coventry, Birmingham, Liverpool, Manchester, Portsmouth, Southampton, and Hull. Some had minor attacks which no doubt seemed more important to them, but in a whole year this has had singularly little effect on the output of munitions. In spite of all this bombing, output of all kinds, and particularly of aircraft went up and up.

According to the calculations of our Headquarters based on the reports of the Observer Corps the Germans at times had anything between 300 and 500 aeroplanes concentrated on one or other of these objectives. And the comparatively small effect achieved bore out the opinion of many experienced war-makers that although bombing is one of the most important factors in war, no war can be won by bombing alone.

The reason is that to break a country utterly by bombing, the

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whole country must be bombed. Human nature is such that, although one may be very sorry for one's neighbours' sufferings, one is not convinced until one has suffered oneself. The villagers round London were sorry when they heard of the damage done to the City, but they were still able to work and sleep and eat in peace and their moral state did not suffer in the least. And this applies to all the surroundings of all the bombed cities.

Many people profited greatly by the number of people from the bombed cities who came out to live in the villages. And if the village shops had been able to get supplies of anything the shop-keepers would have made their fortunes. As the shop-keepers of the big towns have made their fortunes by taking the money away from the villages, this would have been a fair exchange, only unfortunately Government control of all goods limited the supplies to the villages.

THE 'BOMB BERLIN' FALLACY

There is no reason to think that Germany has suffered any more or any less. And the smashing of Berlin by bombs affects the German people as a whole even less than the smashing of London affects the English people—let alone the Scots and the Welsh and the Irish. Berlin is a new city, Germany is a new country, and whatever attachment the people have is to the capital cities of their own old separate kingdoms. A Bavarian would be much more affected by the smashing of Munich than by the smashing of Berlin. And any villager would be more affected by the smashing of his own village than by the smashing of the nearest town.

Consequently what one might call political bombing can have practically no effect. Heavy bombing of industrial centres is more effective because to some extent it cuts down the supply of war materials. But even that does not affect the will of the people to carry on the war, especially in Germany, where so much of the industrial work in these days is done by factory

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hands who have been pressed into service from the conquered and occupied countries.

DISPERSAL

In Germany every village has its little armament factory. The late Helmuth Hirth told me some four years ago that his aeromotors were not made at his factory, they were only assembled there. All the parts were made in little workshops which he had set up in villages all the way round Stuttgart. And he said that no one part was made in one factory, he always had at least two factories making a part, so that if one were bombed the other one only had to speed up its output till the damaged factory got going again.

At that time the best people in Germany were expecting to be bombed by Russia. One chief of a big new German aircraft factory, when I remarked jokingly on the immense care that they had taken to guard the workpeople against bombing, replied, 'You forget that we are eight hundred miles nearer Moscow than you are.'

There is no doubt that even as early as 1936-7 the heads of the Aircraft Industry in Germany were far more bomb-conscious than was anybody in this country, from the heads of the Government downwards.

That is why the Germans were already firm believers in the Doctrine of Dispersal, while we in this country were building vast shadow factories for our aircraft in which the shadows were much larger than the substance and in fact more substantial. The fact that few or none of those shadow factories has been hit to any notable extent is just one of the eccentricities of war and an example of the inaccuracy of bombing, for nearly all the shadow factories built before and since the beginning of the war are much vaster targets than the old targets.

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STIRRING UP THE STATES

Apart from the fact that the Battle of Britain did undoubtedly stop for a year any attempted invasion of this country, either by big forces of bombers plus parachute-troops or by sea, it, and the blitzing of our cities, also stirred up the United States. At that time the question of a Third Term for Roosevelt had only been vaguely discussed, and the Lease-and-Lend Bill had not been discussed at all, except possibly in the inner circles of Anglo-American finance.

But things were happening in America which obviously meant that the States were going to help us in some way. For instance the *Wall Street Journal* stated that Great Britain was planning to build a chain of aircraft factories in the United States which would produce about 1,300 aeroplanes a month by the latter part of 1941. I believe that in August 1941 the whole Aircraft Industry of the United States produced about 800 aeroplanes.

Mr. Morgenthau, after Lord Beaverbrook's announcement that the United States would supply Great Britain with 3,000 aeroplanes a month, said that to do this forty-eight new factories would be needed, but that Great Britain had agreed to pay for them and buy their output. Meanwhile the U.S. Aircraft Industry, remembering the over-expansion during the last war, waited for the decision of the U.S. Government about financial arrangements.

The U.S. War Department, always practical, marked out a 'safety area' in which it would prefer new factories to be built, something like what we used to call the 'funk line' in this country, from Edinburgh to Portsmouth, and this area was said to be 200 to 400 miles inland from the Atlantic coast, inside which in fact are most of the coal and metal industries of the States.

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A SPORTING EFFORT

On August 1st, five companies, Douglas, Lockheed, Boeing, Vultee, and Consolidated, issued a joint statement that they were going ahead with preparations to increase their production without waiting to know what Congress was going to do about it. They said that on their own responsibility the U.S. Aircraft Industry had bought more than 100 million dollars' worth of material and had added 21,000 more employees to their pay-rolls and had contracted for more than 50 million dollars' worth of additional plant. Those companies mentioned have certainly contributed more than any others in the United States to the bombing strength of this country.

I may remark here that the most disappointing part of the whole aircraft programme was the small progress made in Canada by Federal Aircraft Ltd., a vast organization which was formed to pool the resources of the comparatively small firms which made up the Canadian Aircraft Industry.

Nobody regretted this failure more than did the better Canadians. There was a first-class row in the Canadian papers about it and a heated debate in Parliament. Of course the critics were denounced as enemies of the country and political agitators and Fifth Columnists and so forth, but by the end of 1940 the High Authorities were bound to admit that the critics were justified.

In September 1940 Federal Aircraft Ltd. announced that they would be producing 360 aeroplanes a month early in 1941.

In the meantime some few independent firms were turning out quite a lot of stuff, though mostly of the smaller types, and no big bombers had reached this country from Canada until well on into 1941, other than bombers from the United States which flew to this country from Canada. Most of the United States bombers flew from Newfoundland.

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LORD BEAVERBROOK'S HUSTLE

Round about September and October 1940 Lord Beaverbrook's great campaign to hustle production of British aircraft was in full blast. There was at that time undoubtedly a serious shortage of aluminium, which later on was traced to financial operations in the United States, and definite attempts to prevent the growth in the States of new firms which would increase the output of aluminium.

Lord Beaverbrook, in his usual energetic way, started what one might call a raid on the kitchens of England, and besought the housewives to contribute all their aluminium pots and pans to a common dump in each district, the products of which would be collected into factories where the utensils could be converted into aeroplanes. The housewives responded nobly at great self-sacrifice, and possibly to the ultimate good of the health of their families—for many doctors hold that aluminium is not healthy for cooking.

No figures for the amount of aluminium collected have been published so far as I know, but certainly a number of aeroplanes must have profited by the raid, because, although the stress-bearing parts of aeroplanes are generally built of Duralumin, a great many unstressed parts are covered with plain aluminium. And I have been told by those who know that the kind of aluminium which is used in pots and pans cannot be converted into Duralumin.

CHAPTER 21

Major Changes at the Air Ministry



On the 11th of October 1940 major changes were made in the Air Council and in the Air Commands. Air-Marshal Sir Charles Portal took over the office of Chief of the Air Staff from Air Chief Marshal Sir Cyril Newall, who afterwards was made Governor-General of New Zealand. Air-Marshal Sir Richard E. C. Pearse, who had been Vice-Chief of the Air Staff, was appointed Air Officer Commanding-in-Chief Bomber Command. At about the same time Air-Marshal Sir Hugh Dowding, who had commanded the Fighter Command from the year before the war, was succeeded by Air-Marshal Sholto Douglas.

Sir Hugh Dowding, who was already a K.C.B., was promoted to be a Knight Grand Cross of the Bath and was sent to America to encourage the production of American aircraft. He had been Air Member for Supply and Research at the Air Ministry some years before and as an Artillery Officer was well-trained to take on such a job. The result of his visit was wholly salutary. Shortly afterwards Air Vice-Marshal Sholto Douglas became an Air Marshal and was later knighted.

For purposes of historic reference I may note here that Coventry was bombed on November 14th, Birmingham on November 22nd, and Southampton on November 23rd. After those dates they were all bombed several times again, but those were the original blitzes.

To give any consecutive or detailed history of the bombing of

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various parts of England and of the operations of our own bombers in a book of this size and scope would be impossible. I therefore propose to mention merely the more important developments or happenings in bombers and bombing in more or less chronological order, so that readers may have a general picture of how this side of the war developed.

THE FIRST BIG BOMBERS IN USE

The first use of four-engine bombers appears to have been on Monday, the 2nd of September, when either Focke-Wulf Condors or Junkers 90's were used over England. The cruising speed of the Condor, which was a passenger liner, and of its military version the Kurier, was between 230 and 240 m.p.h. As it was designed for long range it can carry heavy bombs.

This appears to have been the trying-out particularly of the Kurier, which at a later stage was used for Atlantic patrols. These machines have been taking off from aerodromes at Bordeaux, flying round the west of Ireland and over the sea between Iceland and Scotland, and landing in the extreme north of Norway. There the Germans have a runway which is said to be about two miles long and more than 100 yards wide, so that loaded with fuel and bombs for the long return journey, most of it against the prevailing winds, out into the Atlantic, the machines may be able to get off without destroying themselves.

The chief use of these long-range bombers has been as scouts to locate our shipping convoys and signal their whereabouts to German submarines and commerce raiders. As a secondary job they have done much damage in bombing our convoys. Some of them have been shot down by anti-aircraft guns, some by Coastal Command Hudsons and some by Sunderland flying-boats. Latterly fighters have been catapulted off merchant steamers in convoys to attack the Kuriers. The results have been very good. After the fight the fighter tries to reach land, or just sits down in the sea and hopes to be picked up.

Major Changes at the Air Ministry

Unfortunately we have not had enough aircraft-carrying ships during the first two years of the war to provide such a patrol of the Atlantic sea-lanes as would abolish this particular menace to our supplies. But that will come in time.

INCENDIARY LEAFLETS

During the dry summer of 1940 some of our bombers were set to do curious work. A private inventor took to Mr. D. R. Pye, Director of Scientific Research at the Ministry of Aircraft Production, an idea for an incendiary leaflet, a very different thing from the bomphlets of a year before. These leaves were made of celluloid and covered with a substance, presumably a phosphorous mixture, which is harmless when kept in the dark but combusts spontaneously in daylight.

Quantities of these were dropped into the forests of western Germany in which our Intelligence Service, or spies, had told us there were many small dispersed factories. When the daylight came the leaflets caught light and set fire to anything which came in contact with them.

Little was heard of the military effects of this operation and nothing was heard about them during 1941. Possibly their use may have been dropped because of the somewhat natural outcry from Germany about the injuries which they did outside military objectives.

The chief one was that they fell on the roads and gardens and that children going to school in the early morning picked them up and were burned when exposure to daylight set them on fire. Other children thought they were something to eat and ate them and had their lips and mouths burned. In any case the military damage done does not seem to have been worth while.

AIR POWER IN THE PACIFIC

Because of threats by the Japanese in the Pacific in November 1940 Air Chief Marshal Sir Robert Brooke-Popham was

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appointed Commander-in-Chief of the Far East. Under his command are the General Officers commanding Army units in Malaya, Burma, Hong-Kong, and the Air Officers commanding in the Far East, who co-operate with the Naval Commanders-in-Chief in China and the East Indies and the Commander-in-Chief India.

Naturally he is closely in contact with the Governors of the Colonies in the Far East and with the Commonwealths of Australia and New Zealand. And in this way he comes directly in co-operation with an old colleague and friend, Marshal of the R.A.F. Sir Cyril Newall in New Zealand.

The whole network of air defence in the Pacific, with bases in New Zealand, Australia, Fiji, Hong Kong, and Malaya, and links with the American-owned islands and with the Netherlands East Indies, were worked out some years before the war by Air Vice-Marshal Tedder, A.O.C. at Singapore, Air-Marshal Sir Arthur Longmore temporarily in Australia, and the Australian Air Staff and the other Powers concerned.

When Sir Robert took over at Singapore the Air Force there consisted of quite obsolete fighters and bombers, under Air Vice-Marshal John Babington. Since then Air Vice-Marshal Pulford has taken over and the Air Force has been reinforced by vast quantities of British and American aircraft, both land machines and flying-boats. Also a number of squadrons of the Royal Australian Air Force have been sent to Singapore, so that the port and the whole of Malaya is well defended by air.

When one considers that by no possibility could the Japanese put as many as 500 aeroplanes into one attack, and that any British Home or Dominion fighter squadron could take on Japanese aviators in a ratio of ten-to-one, judging by what our people have done with the Germans and Italians, there need be no anxiety about air attacks on Malaya.

CHAPTER 22

The Answer to the Night Bomber



Just before Christmas 1940 Air-Marshal Sir Philip Joubert de la Ferté, who at that time was an Assistant Chief of the Air Staff, said in a broadcast speech that he looked forward to the time when German losses in night raids would be proportionately as high as their losses had been during the Battle of Britain. The inference was that, when the percentage of German losses became so high, night-raiding would cease. Sir Philip was at that time particularly in charge of the development of devices with which to fight night-raiders. Consequently he had a greater knowledge than anybody else of what was being done and was therefore better able to speak on the subject.

He gave some hints of a device which would enable our night-flying fighters to find and bring down night-raiders. And a great many people in this country already had a good idea of the general principles on which the device worked and how it operated.

A few days after Sir Philip made his statement there was a rather heavier blitz than usual on London and a London daily paper published an attack on Sir Philip headed, 'You Spoke Too Soon, Sir Philip'. Naturally the justice of the attack depended on the interpretation of what was 'too soon'. I said then in print, and have maintained since, that Sir Philip was wise in giving the people a definite promise that something was being done to abolish the menace of the night-bombers. And since

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then his words have been fully justified. I happened to know just what was being developed and knew that several night-bombers had already been brought down by our night-fighters and the strange device.

As Sir John Salmond said when he was Chief of the Air Staff years before the war, 'Some of the bombers will always get through.' But whether raiding ceases or not depends entirely on the proportion of bombers brought down compared with those which are sent to attack. There is a limit to the percentage of losses which any fighting force will stand. General Ashmore found the German limit in March 1918. We shall find it in this war.

Thereafter at intervals references appeared in Air Ministry communiqués to the 'device' which the R.A.F. was using against night-bombers.

A little later the Germans published an account of what they call the *Wolkenröntger*, which according to their accounts is a kind of television apparatus carried in an aeroplane on which the observer is able to see any aeroplane within some considerable distance. They claimed that the *Wolkenröntger* had actually been able to show gun-positions on the ground.

The Germans have always been good on rays of various sorts, and, though the idea of an instrument which will see something which is out of sight seems fantastic, one never knows. An ordinary television apparatus is understandable enough because what one may call the camera sees what is put within a short distance of it and transmits that image by radio to a suitable receiver, which reproduces it on a screen. One might even have a telescope-television camera which would see things beyond the range of the human eye and would transfer them to a screen which was close up to the camera, but in that case one might just as well project what the telescope saw direct onto the screen. It is conceivable that the Germans may have an idea of that sort working on infra-red or ultra-violet rays.

The name *Wolkenröntger* is made up of the words *Wolken*,

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meaning a cloud, analagous to our word welkin, the kind that rings to the chorus of a song or such noise, and the name of the famous Dr. Röntgen, who discovered X-rays—which we used to call Röntgen rays.

LETTING OUT THE CAT IN CANADA

Whether our device works on any such principle one may not know or say. But early in 1941 Mr. Power, the Canadian Air Minister, appealed, in a speech which was broadcast all over Canada, to young Canadians to join up in the Royal Canadian Air Force for the special duty of working a radio device which was being used to detect the presence of enemy aircraft.

I have not his exact words, but the impression he gave was that all one had to do was sit on the ground with a little box to pick up enemy aircraft in daylight or dark, fog, rain, hail or snow, by some species of bouncing ray, or radio écho, and report position and direction of travel by telephone to the nearest R.A.F. Observer Station, whence the information would be transferred to local Fighter Command, where the movements of the enemy aircraft would be plotted on maps, so that the Commanding Officer and his Staff watching their movements could communicate by radio telephone to their squadrons in the air the precise direction in which they must go to pick up the enemy raiders.

I have been told that by clever co-operation in all these processes our fighters can be put within a very short distance, measurable in yards, of enemy aircraft. After that the fighter has the job of getting within accurate gun-range of the enemy. How well they have been able to do this, irrespective of the means employed for the last few yards, has been shown by the number brought down during the fighting in the blitzes of the spring and summer of 1941.

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RADIO-LOCATION

Since then the prospects of night-raiders which come to this country have definitely become poor. One of the beauties of this device is that people can be trained to use it just as well by day as they can by night. For years we have trained pilots to fly in the dark by instruments alone, simply by putting a hood over their heads so that they had to fly in the dark. And while they have been doing so their instructors, out in the daylight, have been able to telephone instructions to the pilot under the hood. In the same way a pilot flying under a hood takes his instructions from people sitting on the ground, and can fly in the right direction by using ordinary night-flying instruments.

Although obviously the Germans must attack us by night, we need have no doubt about the results in the end. One reason why our attacks on night-bombers were not so successful as they might have been was that we lacked a first-class twin-motor two-seater fighter, carrying heavy guns. By the summer of 1941 we had acquired the Douglas Boston bomber, which, when equipped with night-flying armament and apparatus, the R.A.F. called the Havoc. And it did very good work. But towards the end of 1941, by far the best night-fighter was the Bristol Beau-fighter, which with two Bristol Hercules sleeve-valve two-row radial air-cooled motors of 1,300 h.p. had a very high performance. It could carry enough armament and ammunition and fuel to cruise around for a long time, and had enough speed to catch any German night-bomber and enough fire-power to blow it to pieces.

FACTS AND FIGURES

Sir Philip Joubert's prophecy or promise was justified during the week ending the 13th of May 1941, when 139 German aeroplanes were destroyed, of which 102 were shot down at night.

The last time this figure was exceeded was during the week

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ending the 28th of September 1940, when 225 aeroplanes were destroyed, but only six of them were shot down at night. Thus the percentage of night-raider casualties had risen from 2.65 per cent to 73.5 per cent.

On the night of May 10th, when there was a big air-raid, thirty-three German aeroplanes were shot down, which, probably, was about a tenth of the number engaged. That might be called decimation, if one agrees that losing one in ten is decimation and not that only one in ten survives. If night-raiding goes on long enough in the end only one raider would survive out of every ten. But raiding would cease long before the losses reached such a figure. Few fighting forces will stand up to a heavier rate of loss than 50 per cent.

In those insane infantry attacks by hundreds of thousands of men at once in the War 1914-18, whole battalions used to be wiped out. Even in this war only a few dozen men survived, or at any rate reached England, after a brigade of riflemen had been cut off at Calais. In Russia each side claims to have wiped out millions of the other. But what counts is the percentage of loss among the total number engaged. A whole squadron of the Air Force might be lost in one big attack, as at Maas-tricht, but if twenty or thirty other squadrons survived, that loss would not stop operations.

An interesting fact is that out of the thirty-three bombers shot down in that raid on May 10th, twenty-nine were shot down by fighters and four by anti-aircraft guns. Which supports the R.A.F. argument that we should be better off without the guns. The guns make much noise, but what they shoot up has to come down, and in doing so it does a great deal of damage. And the shells fired in a big raid probably cost much more than do the aeroplanes used, most of which come back in one piece.

These results show how far advanced we were with the 'device' in May 1941. And from then onwards the number of Beaufighters which were coming out of the factories increased

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enormously and the number of crews trained to operate them also increased quickly. Although serious raiding practically ceased after that date, presumably largely because of the concentration of the Luftwaffe in Eastern Europe in the attack on Russia, every now and then bombers came over the south and east coasts of England and almost invariably some of them were shot down.

When one considers that the bombers may be coming in at any height up to about 25,000 feet, a matter of about five miles, on a front of nearly 1,000 miles, if one takes the coast all the way from Land's End to John o' Groat's round by Dover, one begins to realize how immensely efficient the radio-location system must be to spot a solitary aeroplane in the sky in the dark.

But considering their limitations, especially that they are tied down in one place and have to wait for their target to come within range, instead of being able to go up and chase it as the aeroplanes gunners do, the anti-aircraft gunners have done quite well against bombers.

THE OFFICIAL ANNOUNCEMENT

Radio-location was made known officially in Parliament by Mr. C. R. Attlee, Lord Privy Seal, on the 17th of June 1941. Lord Beaverbrook, as Minister of State, broadcast about it to America on the same day and Air-Marshal Sir Philip Joubert, who has been its official godfather, talked about it at a Press Conference on the same day.

The principle of the radio-location apparatus has been known to scientists for many years, but in 1935 Mr. R. A. Watson Watt, who for some years has studied the various forms of radio-tele-communication to the Air Ministry, started a series of experiments at Daventry. In 1938 he was appointed Director of Communications and Development at the Air Ministry and in January 1940 he became Scientific Adviser on Telecommunica-

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tions at the Air Ministry. He has since been transferred to the Ministry of Aircraft Production on the same job.

Sir Frank Smith, K.C.B., Secretary to the Department of Scientific and Industrial Research, was also concerned with the development of radio-location. From a purely Service point of view Sir Philip Joubert, who was appointed Air Officer Commanding-in-Chief Coastal Command, in succession to Sir Frederick Bowhill, in June 1940, had spent the previous eighteen months in developing radio-location.

THE 'RADIOURA'

I may note here that in 1925 in *The Aeroplane* I urged the scientists of the world to discover some method by which an aeroplane could detect the presence of another aeroplane near it. I suggested that an aeroplane might fly in a sort of aura of radio waves and that when these waves impinged on one another or when one aeroplane came within range of another, the apparatus should be able to pick up the direction of the second machine automatically. All machines would send out their signals continually and automatically, and every machine would be compelled by law to carry what I called a 'radioura' apparatus, just as a car has to carry a horn.

Some time afterwards Dr. Lewis, the Chief of the National Advisory Committee for Aeronautics in the United States and head of the great research establishment at Langley Field, wrote to me that his people were working on the possible development of such an apparatus. Now, fifteen years later, seeing that the thing was working in 1940, we seem to be somewhere near it.

This radio-location beam is to the raiding bomber as deadly a weapon as the fighters' machine-guns. Moreover, thanks to radio-location, fighter squadrons can sit on the ground, so conserving petrol and nervous energy, until told by radio-location that enemy aircraft are approaching. Thus we are saved the

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trouble and expense of maintaining patrols in the air, of the kind that are known as 'standing' patrols, presumably because they never stand still.

We may also suppose that the Germans have something of a similar kind. At any rate, their *Wolkenröntger*, which I mentioned earlier in this book seems to be much the same sort of thing, and according to them their television-radio-location arrangement is carried in the machine itself.

CHAPTER 23

Development in Big Bombers



In December 1940 the African operations began. Such bombers as Air Chief Marshal Arthur Longmore had in Egypt were turned on to the destruction of Italian positions in Libya. Most of them were Blenheims. There were some few Wellingtons in Egypt at the time. A month or so earlier Air-Marshal Boyd had started for Egypt in a Wellington to act as Second-in-Command to Air Chief Marshal Longmore and had to land with his staff in Sicily, where he was taken prisoner.

Shortly afterwards Air Vice-Marshal Tedder, released, or escaped, from the Ministry of Aircraft Production, flew out to Egypt, also in a Wellington, which at that time was our only bomber which had enough range to fly non-stop from England to Malta.

The campaign against the Italians in Abyssinia also started about the same time. In this we used old single-motor Vickers Wellesley bombers. Three of the type had set up a long-range record by flying from Egypt to Australia non-stop the year before.

In this campaign most of the early bombing was done by a Rhodesian squadron in Blenheims. Later they were joined by squadrons of the South African Air Force, which were using Ju.86's, some of which had Rolls-Royce motors. These machines had been bought in Germany by Mr. Oswald Pirow when he was Minister of Defence and Communications for the Union of South Africa and so controlled both the South African Air

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Force and South African Air Lines. He is of German descent, if not actually of German birth, and somewhat naturally his sympathies were pro-German. But he did get good modern aeroplanes for the S.A.A.F.—which for some odd reason has never claimed to be Royal as are the R.A.F. and the R.A.A.F. and the R.N.Z.A.F. and the R.C.A.F.

TELLING THE WORLD

A mild sensation was caused among British newspapers about the end of December 1940 by an article in an American aeronautical paper which described, more or less, the Hawker Tornado, the Westland Whirlwind, the Avro Manchester, and the Short Stirling. Without saying even now to what extent the description was accurate, I may record that the Manchester was described as a twin-engine bomber driven by Rolls-Royce Vulcures. Its speed was given as 325 m.p.h., its gross weight as 30,000 lb., and its span 90 to 95 feet.

The Short Stirling was described as a four-motor bomber, bigger and faster than the Flying Fortress, and was said to have been derived from a Trans-Oceanic commercial aeroplane design projected before the war but abandoned. That is possible. But there is more to say about it in the section of this book which describes the Stirling.

According to the American paper the Stirling weighed 71,000 lb. all up. And it was supposed to have four Bristol Hercules sleeve-valve motors of 1,380 h.p. each. Its span was given as 127 feet 6 inches and its range as 3,000 miles. The statement was also made that existing Wellingtons and Whitleys had been 'beefed-up' by giving them engines of 2,000 h.p. instead of 1,000 h.p., which was supposed to put the speed of the Wellington up to more than 325 m.p.h. The Whitley was supposed to go up to more than 300 m.p.h. The Handley Page Hampdens, which were also supposed to have 2,000 h.p. engines, were to go up to 340 m.p.h.

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The American paper also discovered the Bristol Beaufort bomber, with two Bristol Taurus sleeve-valve engines which had a speed of 310 m.p.h. and weighed about 6½ tons all up. It had already been mentioned in our own papers and in Australia.

The article was written by a journalist who had been here for a long time as a neutral observer, and had been treated as a man and brother by people in the R.A.F. and in the Air Ministry. His article was not viewed with favour by the senior aviation papers in the States, which had quite as much information, but did not think that it was proper to publish.

LONG-DISTANCE RAIDING ON THE CONTINENT

The advantage of the long winter nights to night-bombers may be judged by a few dates which were registered as notable in *The Aeroplane*. On the 27th of October 1940 the Skoda works at Pilsen were raided by the R.A.F. for the first time. On October 31st a record long-distance raid was made by the R.A.F. when several machines bombed Naples, a distance of 1,300 miles—650 miles there and back. November 3rd was London's first night without an alert after September 7th. On November 10th (still longer nights) the R.A.F. raided Danzig and Dresden.

On November 11th the Naval Air Service and the R.A.F. made the historic combined bomb and torpedo raid on the Italian Fleet in the harbours at Taranto. On December 20th the R.A.F. made its biggest raid on Berlin up to that date. On the other side we may record that on December 29th the Luftwaffe made its biggest incendiary attack on the City of London.

U.S. BOMBERS ACROSS THE ATLANTIC

On the 8th of January 1941 Air Chief Marshal Sir Hugh Dowding, who was on a special mission to Washington, men-

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tioned in a speech that American bombers were then being flown regularly across the Atlantic to Great Britain. The machines which had arrived were nearly all Hudsons which were fitted with special tanks in the cabin to give them extra range.

Boeing Flying Fortresses and Consolidated Liberators and Consolidated Catalina flying-boats had not yet started to cross.

This Trans-Atlantic Ferry Service was one might almost say invented, certainly organized, by Mr. George Woods Humpherys, who was formerly Managing Director of Imperial Airways Ltd., and was chiefly responsible for the building up of that vast organization. It was undoubtedly successful. Later it became known officially as Atfero.

Here is a catalogue of the American bombers which had been ordered as early as January 1941 for the R.A.F. In alphabetical order they are:

The Boeing Flying Fortress, four-motor heavy bomber.

The Brewster Bermuda, single-motor dive-bomber.

The Consolidated Liberator, four-motor heavy bomber.

The Consolidated Catalina, two-motor flying-boat.

The Curtiss Cleveland Helldiver, single-motor dive-bomber.

The Douglas DB-7, the Boston two-motor medium bomber

Havoc night-fighter.

The Douglas DB-280 (Digby) two-motor medium bomber, a lower type which was delivered mostly to the Royal Canadian Air Force for training.

The Douglas DB-320, two-motor medium bomber, none of which had been delivered by the end of the second year of war, September 1941.

The Lockheed Hudson, two-motor medium bomber.

The Martin Maryland, two-motor medium bomber, originally ordered for the French but transferred to us.

The Martin Baltimore, a later type and more powerful medium bomber, also not being delivered by September 1941.

The North American N.A.40A two-motor medium bomber, also awaited.

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The Northrop A17A single-motor dive-bomber.

The Vought-Sikorski Chesapeake, single-motor, also a dive-bomber.

The Vultee Vengeance, single-motor dive-bomber.

Those which were being delivered by September are described in Part IV of this book, together with biographical notes on their origin.

CHAPTER 24

Light versus Heavy Bombers



During 1940 controversy had been raging among technical people in British Aviation about the possibility of an idea put forward by Mr. Noel Pemberton-Billing, formerly M.P. for Hertford, whose name has been mentioned earlier in this book in connection with the raid on the Zeppelin sheds at Friedrichshafen.

At the end of 1939 he produced an idea for a small single-seat monoplane bomber which would carry a very large load of bombs by flying at an enormously high speed. The figures mentioned were two or three tons per machine at 450 m.p.h. Given a high enough speed the load could be carried along with enough petrol to get it to the far side of Germany. The trouble was to get such a heavily-loaded machine off the ground. Mr. Billing's idea was to fix on top of the little bomber a very large glider complete with pilot. Because of its variable pitch airscrew the bomber with the glider on top would be able to get off the ground at a low speed, say 40 or 50 m.p.h. The combined aeroplanes would then fly to a height which experience showed to be safe, and there the pilot of the bomber would, so to speak, press button A, the glider would be released and lightened of its load would rise quickly. At the same time the little bomber would drop and in doing so would pick up the very high flying speed which otherwise it would never be able to reach. The glider pilot would then bring his machine back to the aerodrome and hitch up to another bomber.

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This invention of Mr. Billing's was called the 'Slip-wing'. Some two or three years before Mr. Stieger, a Swiss engineer then in the employ of the Blackburn Company of Brough, had put up a similar idea, but instead of having a glider with a pilot to bring it home he had a detachable wing which the pilot of the bomber would release when he got out over the sea so that the wing would not be likely to damage persons or property on land. This was nicknamed the 'Scrap-Wing'.

Technical people at the Air Ministry had been so far interested in the Stieger idea that orders had been given to build a trial machine. One of the little racing monoplanes designed by Mr. F. G. Miles and built by Phillips & Powis for the King's Cup Race, some years ago, was bought to play the part of the little bomber. Then another set of technical men disbelieved in the idea and cancelled the order. Later it was revived and again cancelled.

Mr. Pemberton-Billing suffered likewise from the inability of the official mind to make itself up. A number of quite intelligent people at the Air Ministry favoured the idea of building a slip-wing. Mr. Pemberton-Billing offered to build the machine at his own expense if he were allowed permits to buy the material and if a motor were lent to him. But even that did not induce the technicians to support his idea.

All sorts of arguments were produced in favour of experiments but they were defeated by the same official people who put up precisely similar futile objections to such simple things as all-metal construction, retractable undercarriages, variable pitch air-screws, and most of the other things that make the modern warplane superior in performance and in general safety to the warplanes of 1914-18. There definitely is an official type of mind which considers that its duty is to reject rather than to inspect new ideas.

There was some talk of a similar idea being developed in Germany and there is always a possibility that such light bombers may be in production. Seeing how little we knew about

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the German organization for the handling of parachute-troops and of the troop-carrying gliders, there is always a possibility that the Germans may be taking advantage on the quiet of all the controversy which appeared during 1940 in our aeronautical papers about Mr. Pemberton-Billing's and Mr. Stieger's inventions.

Without committing myself to complete faith in the idea I do say that it appeals to me as a possibility and I do think that we have been criminally neglectful, or that some officials have been criminally obstructive, in not making a few of these slip-wing or scrap-wing bombers as experiments.

ATLANTIC DELIVERIES

In February 1941 Colonel John Jowett, President of the Aeronautical Chamber of Commerce of the U.S.A., made the statement that 400 bombers had already been flown across the Atlantic to Britain. People in this country who were in touch with this work doubted the figure, not because the aeroplanes had not been built but because there were not enough pilots at work on the Trans-Atlantic Ferry at that time to deliver such quantities.

The bottle-neck in the service was getting the pilots back to Newfoundland or the United States to bring new machines over. The voyage from America to England was only taking about ten hours but getting these pilots back by boat was a long job, which took a couple of weeks. Later on when the big fast Liberator bombers began to arrive some of them were told off to fly pilots back to America twenty at a time, and forty-four good men were killed thus in one week through no fault of the aeroplanes.

Incidentally there was a good deal of ill-feeling in the ferry services at home, the Air Transport Auxiliaries, who deliver aeroplanes from the makers to the R.A.F., because Lord Beaverbrook had imported to this country from the States a

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number of American pilots who were being paid at the rate of £3,000 per year. Some of them were experienced air line pilots but could not fly across country by compass because they had always flown by radio beams, and some were wholly inexperienced. Meanwhile British pilots were getting about £500 per year, made up by bonuses, to about £800 for the more skilful and senior pilots, and yet they were trusted to fly our valuable big bombers.

OFFICIAL DISCLOSURES

The Stirling bomber about which there had been so much talk first went into action about the 20th of February 1941. Since then they have been regularly carrying big loads mostly to Germany but occasionally to Italy and to occupied territory, particularly against the German warships *Gneisenau* and *Scharnhorst* at Brest and La Pallice.

Another disclosure in February was that we were training parachute-troops and that one of the chief instructors was Lieut.-Colonel Louis Strange, D.S.O., M.C., D.F.C., who had won a bar to his twenty-year-old D.F.C. by gallantry in France in June 1940. The officer in charge of the training establishment, when the parachute-troops were tried out in a raid on the railways of southern Italy, went with them in one of the machines which dropped them and thereafter gave a vivid description of the operations in a broadcast from the B.B.C.

An amusing accusation by the Germans was that we had landed parachute-troops to cause anti-Nazi rioting and strikes in Holland. Apparently instead of dropping them to commit acts of sabotage on material objects we were dropping political and moral agitators.

Sir Archibald Sinclair, Secretary of State for Air, let several cats out of bags in his Air Estimate speech on the 11th of March 1941. He said that the Short Stirling, the Avro Manchester, and the Handley Page Halifax bombers had 'already

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shown their worth against enemy targets'. This was the first reference to the existence of the Halifax, though naturally many thousands of people had seen Halifaxes flying.

The justification of Sir Philip Joubert began to show in March when in one week thirty-six bombers were shot down after dark, and of these twenty-one were destroyed by night-fighters. At that time our night-fliers were Hawker Hurricanes, Supermarine Spitfires, Boulton-Paul Defiants, Bristol Beaufighters, and Douglas Havocs.

The existence of the Beaufighter was also revealed by Sir Archibald Sinclair in his speech. As the name suggests, the machine is a close relative to the Bristol Beaufort Torpedo-bomber, but it is built solely for fighting and not for bombing or torpedo work and therefore does not concern us, except in the results when it gets the German bombers.

Speaking of the Halifax, Sir Archibald Sinclair said, 'These bombers are more than twice the size of any earlier type—they are faster and carry not only a heavier defensive armament but also three times the weight of bombs to the same distance as their predecessors.' The Vickers Wellington carries 2,500 lb. of bombs and can fly for 2,000 miles.

The first of the much expected and advertised Consolidated Liberator four-motor bombers arrived by air from the States on or about March 22nd. No official figures have been published about it, but the type used by the U.S. Army has a top speed of 335 m.p.h. and a range with full military load of at least 3,000 miles. The machine has four 1,200 h.p. Pratt and Whitney Twin-Wasp motors and a tricycle undercarriage. Its total loaded weight is said to be more than 41,000 lb.

Although our torpedo-bombers, using both weapons, had been successful against individual German ships in the North Sea and in the Mediterranean, the first big exhibition of the uses of air-power at sea was given on the 28th of March 1941, in the Battle of Cape Matapan in the Ionian Sea, when Admiral Cunningham's fleet fell in with a considerable Italian fleet

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in which was the crack Italian battleship *Vittoria Veneto*, named after the final victory of the Anglo-Italian Army over the Austro-German Forces in 1918. The Italian ships were faster than ours, but Blenheim Beauforts of the R.A.F. flying from Africa and torpedo-spotter-reconnaissance Swordfish or Albacores flying off H.M.S. *Formidable*, our latest aircraft-carrier in action at that time, so damaged the fast Italian ships that the British Fleet was able to overtake them and do much damage. The *Formidable* is one of the many successors of H.M.S. *Illustrious*, which was the first of a new type of aircraft-carrier.

About a year before the war I was told by an officer of high rank in the Navy who is keen on Air Power that H.M. Aircraft-carrier *Illustrious*, when completed, would be as nearly unsinkable ship as was possible and that she would be the last word in carrying capacity, in speed, and in everything else. Since then the *Illustrious* has been severely damaged by a hammering which would have sunk almost any other ship in any Navy. But she reached Malta under her own power and eventually crossed to America, where she has been completely repaired and Captain Lord Louis Mountbatten, son of the late Prince Louis of Battenberg, who, as First Sea Lord of the Admiralty, mobilized the British Fleet just before the outbreak of war in 1914, with the help of Mr. Winston Churchill, then First Lord of the Admiralty, took command in the summer of 1941.

Since then another aircraft-carrier in the *Formidable* class has been commissioned and should add greatly to our naval strength all over the world. One fast carrier equipped with a quantity of high-speed torpedo-bomber craft can do as much to catch surface-raiders and submarines as can a fleet of cruisers with an accompanying flotilla of destroyers.

CHAPTER 25

Capital Punishment



The second half of the second year of war was heralded, one might say, by a Government communiqué, from 10 Downing Street on April 18th which calls for remark. It said:

‘In view of the German threats to bomb Athens and Cairo, His Majesty’s Government wish it to be understood that if either of these cities is molested they will commence a systematic bombing of Rome.

‘Once this has begun it will continue as convenient until the end of the war. The greatest care will be taken not to bomb the Vatican City, and the strictest orders to that effect have been issued. It has, however, come to the knowledge of His Majesty’s Government that an Italian squadron is being held ready in Rome to drop captured British bombs upon the Vatican City should a British raid take place. It is therefore necessary to expose this characteristic trick beforehand.

‘It is a mistake to describe the bombing of Rome last night [April 17] by the R.A.F. as a reprisal for the raid on London the night before. It is not a reprisal but part of a regular policy adopted by the R.A.F., under instructions from the Government, of the bombing of objectives in the two guilty countries, which are most likely to weaken their military or industrial capacity. This policy will be continued till the end of the war, it is hoped on an ever-increasing scale, irrespective of whether any attacks are made on the British Islands or not.’

Capital Punishment

This form of capital punishment is worth considering. There is interest first of all in noting that the bombing policy of the R.A.F. is not regulated by the Air Council but by the Government. Thus we see that political bombing overrides strategic bombing such as would be agreed by the Committee of the Chiefs of Staff of the three Fighting Services, or practical bombing such as would be arranged in co-operation between the officers commanding-in-chief the Services in any given war area.

Obviously the Fighting Services must be under the control of the Cabinet, but whether the Cabinet is the best judge of what ought and ought not to be bombed is open to argument, as anybody may discover who cares to read the results of political direction of Navy, Army, or Air Force actions in the last war—especially in *The Diary of Field-Marshal Sir Henry Wilson*, formerly Chief of the Imperial General Staff and before that our chief Liaison Officer with the French Army during 1917–18.

Whether the smashing of Berlin is preferable to the smashing of German aircraft industries is clearly disputable. Berlin is merely the political capital of a loose federation of nations called Germany. German, as in our word 'germane', only means 'related to'—and in Spanish the same word, pronounced Hermanos, means a brother.

Any individual German would be more affected by the bombing of his own capital, say Munich or Hanover or Dresden, than by the bombing of Berlin. And, if one gets down to basic facts any inhabitant of any village in any country cares much less about the bombing of his capital than he does about the bombing of his own village.

I have often pointed out before and since this war began, that if the whole of London were wiped out it would not affect either the moral state or the war determination or the individual comfort or happiness of any but a small percentage of the inhabitants of the British Isles. The British Dominions overseas would not be affected in any way.

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Just why the inhabitants of Manchester, Coventry, Liverpool, or any other town should respond to the cry 'Bomb Berlin' is difficult to understand, except on the assumption that they believe the individual German thinks more highly of Berlin than they themselves do of London.

By all means bomb Bremen, bomb Hamburg, bomb Frankfurt, bomb Mannheim, bomb the Ruhr, bomb any place which can be reached during the short summer nights and then, when the nights grow longer, bomb the more distant munition centres.

Stuttgart, the home of the Daimler-Benz aero-motors and of the great Bosch magneto firm has hardly been bombed at all. And in every valley which runs into the city, which is beautifully situated on a number of lovely hills, is a string of villages in each of which, long before this war, was a little auxiliary factory which was making bits and pieces for one or other of the greater industries in the industrial suburbs of Stuttgart.

Those little dispersal factories, invented in Germany ten years ago, a system which we did not adopt until our great main factories had been threatened though fortunately not destroyed, should be the 'Target for To-night' and every night.

One curious human characteristic is that while the innate goodness in human nature will make a man endanger his life to rescue a possibly quite worthless human creature who is within sight or hearing, whether drowning in a river or burning in a fire or being crushed in the ruins of a bombed house, he remains practically unmoved by the sufferings of those who are out of sight.

Newspapers can work up a large amount of artificial sympathy about the sufferings of others but the great bulk of human beings are not affected. If that had not been true we should have been at war with Turkey about the Armenian Outrages in the 1890's, and over the Bulgarian Atrocities before that.

Actually the destruction of Berlin would help considerably in the rebuilding scheme which Herr Hitler had well under way before the war. And the destruction of London will, or at any

Capital Punishment

rate should, help quite a lot in the great scheme set forth by Sir William Bressy several years before the war. Capital punishment in the political and architectural sense is as useless as capital punishment is said to be by humanitarians.

CHAPTER 26

The Greek Disaster



In May 1941 we had another exhibition of what bombing can and cannot do. The small British force which had been landed in Greece was bombed out because we had no fighter force with which to keep off the bombers. It was in fact a repetition on a much larger scale of the Norwegian disaster. From Greece a large proportion of our Army and the Greek Army were withdrawn to Crete, which was equally indefensible.

The Germans were able to send unlimited supplies of bombers and fighters to Greece by short hops along a string of aerodromes from anywhere in Germany through Hungary, Rumania, and Bulgaria. Our nearest air-bases were Egypt and Cyprus, both so far away that no existing fighter could get to Crete or Greece and fight and get back.

If there had been in the British Navy, and available, half a dozen aircraft-carriers in the same class as the *Illustrious* and the *Formidable* and they had been stationed with a full complement of fighters a hundred miles or less from Crete, where they could have been adequately protected by destroyers and air patrols against submarine or air attack we might never have lost Greece and we should certainly never have lost Crete. To a modern fighter shooting Stuka dive-bombers is like shooting chickens. And shooting down Junkers 52's full of troops and towing trains of gliders is not war, it is merely murder—admittedly of a necessary kind.

When we were kicked out of Greece the Germans had the

The Greek Disaster

use of the Italian Dodecanese Islands, which properly belong to Turkey. To fly from the southern Greek aerodromes and from those islands to Crete was little more trouble to the Luftwaffe than are our air-sweeps across the Channel over France and Belgium to the R.A.F.

The use of troop-carriers and glider-trains is outside the scope of this book, but they come in here because without the Stuka dive-bombers and the bigger bombers of the Luftwaffe on our troops in Crete, obviously the air-borne troops could not have landed. I have heard soldiers who were there say that if the British Army had been better armed with Bofors guns and the lighter sort of anti-aircraft guns, other than machine-guns, they could have defeated the Stukas.

A new form of attack can affect the actions of even the stoutest fighters without in the least putting them into a panic. Some stout fellows with ordinary machine-guns managed to shoot down Stukas by standing up to them instead of taking cover when the Stukas dived. And many soldiers of the last war have told me that the heaviest kind of attack which can be delivered by dive-bombers is nothing like so terrifying or so effective as was the old creeping artillery barrage.

But the fact remains that if the R.A.F. had been able to use a fighter force we should not have lost Crete. And another interesting fact is that having lost Crete does not matter a whole lot. It has only one good harbour which can be of use to German submarines and that is well within reach of our bombers from Egypt and from Cyprus. We have heard little of the bombing of Candia Bay, so we may assume that neither the Germans nor the Italians were using it much.

Little has been heard of Cyprus, where we have at least one first-class, very large, and well-equipped aerodrome. The Germans have made a few attempts to bomb it, but have done little damage. The value of Cyprus as air base may be disclosed if and when, after this book has appeared, the Germans try to break through Turkey to the Caucasus, or to Persia or to Egypt.

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LIEUT.-COLONEL MOORE-BRABAZON

At the end of April Lord Beaverbrook, who had been Minister of Aircraft Production, was promoted to become Minister of State, a post which was regarded as second-in-command to Mr. Churchill. He was succeeded at the M.A.P. by Lieut.-Colonel J. T. C. Moore-Brabazon, M.C., M.P., who has the distinction of being Licensed Pilot No. 1 of the Royal Aero Club. During the War 1914-18 he won the Military Cross and distinguished himself by helping forward the development of aerial military photography. Also he had a thorough engineering training in his youth and was one of our few first-class drivers of racing cars in the pre-flying days.

The choice was regarded with favour not only because Lieut.-Colonel Moore-Brabazon, commonly known as 'Brab', has a wide and deep technical knowledge of the subject and great historical knowledge of aviation and of war-flying, but because in every respect he is the direct opposite to Lord Beaverbrook. No greater mistake can be made when a big man leaves an office than to try to choose a man of the same characteristics to succeed him. All human beings make mistakes and in choosing a man of precisely opposite character, except in the will to succeed, one man's errors of omission and commission can generally be put right by his successor. And by the end of the second year of war Lieut.-Colonel Moore-Brabazon was doing very well in his new office.

ATLANTIC TACTICS

One of his first tasks was to accelerate the output of big bombers so that they could be used adequately in what had by then come to be called the 'Battle of the Atlantic'. During the long summer days the German submarines had sunk a dangerously large number of ships bringing food and war material to us. Whether the Admiralty was right in herding our ships to-

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gether in sheep-like flocks called convoys, so that a pack of submarines could attack them at will, brought thither by the German long-range bomber-scouts already mentioned, is a matter which is as much disputed by the Navy as it is by the Air Force.

The opposition school holds that by keeping up a constant patrol of long-range flying-boats from the North of Ireland and Scotland and from Newfoundland on the other side, meeting in the middle of the Atlantic, and supplemented by circling patrols of torpedo-bombers from half a dozen or even three aircraft-carriers out in the Atlantic, a properly protected traffic lane could be formed along which cargo ships would travel at their own best speed, and so dispersed that submarines would have great difficulty in finding them. In fact a submarine would only find an individual ship by sheer luck. And the German long-range scouts could be driven out of the skies by fighters from the carriers.

CHAPTER 27

The 'Bismarck' Affair



The greatest achievement of May 1941 was certainly the hunt for and sinking of the German battleship *Bismarck*. This is no place in which to give details of the performance but a few points in connection with it may be mentioned.

The ship was shadowed for many hours by a Catalina flying-boat of the Coastal Command, which several times narrowly escaped being brought down by the *Bismarck*'s guns. The weather was so bad that the boat had to fly almost within range of the guns to keep the ship in sight. This boat brought British warships of all kinds from all directions to cut off the *Bismarck*. Fairey Swordfish and Albacore torpedo-spotter-reconnaissance biplanes tried to torpedo or bomb the ship whenever they could get near it.

Relatives in North Ireland tell me that the people in the north are very proud because the shadowing was done by one of *their* Catalinas. By the way, the flying-boat is called after Catalina Island near Los Angeles, California, not after a 'contemptible Roman conspirator', as one newspaper supposed. And I think that the island was named after a Spanish lady, and not after the conspirator.

A Short Sunderland flying-boat shared the work with the Catalina. The torpedo-spotter-reconnaissance machines came from H.M.S. *Ark Royal*, now one of our older carrier-ships,

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and from H.M.S. *Victorious*, our very newest, whose name was made known to the public for the first time by that event.

The crew of one of the T.S.R. machines had an astonishing adventure which may be told here, though it does not bear directly on the purpose of the book. Either through engine failure or shortage of petrol the machine came down in the wild wet Atlantic out of sight of anything. As it descended the pilot spotted an empty boat and put the machine down close to it. When the crew got aboard they found that it was a brand-new life-boat off an evidently well-found ship and was equipped with everything for a long voyage, full of people. There was plenty to eat and drink, and the boat had full equipment of sails and oars.

They could only assume that it belonged to some ship which had been sunk, that the crew had taken to the boats and had been picked up before they had touched the provisions, and that the boat had been abandoned.

Knowing fairly well where they came down, the crew of the T.S.R. headed for Greenland. After they had been going for a day or two they chanced across a boatload of shipwrecked Danish mariners heading for Iceland. The boats stopped together and had a long argument about whether the Danes should go to Greenland in company with the British boat, or whether the British boat should go to Iceland in company with the Danes. The Navy people handed over their surplus stores and drinks to the Danes, who were rather short, and continued on their way. A day or so later they were picked up by a British warship and brought home. What happened to the Danes I do not know.

RUTHLESSNESS

In the last phase of the attack the *Bismarck* was so badly slowed down by the torpedo-machines that the slower ships of

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the Royal Navy were able to catch her and sink her. Here another phase of bombing came in.

German heavy bombers from the coast of France attacked our ships so heavily that they had to get under way and leave many survivors of the sunk *Bismarck* to drown. The Germans themselves could do nothing to save them.

This raises a nice point. Given that a ship has been sunk or a position has been lost, are the bombers of that belligerent well used in trying to sink enemy ships, or trying to damage enemy troops, when by leaving them alone a large number of their own men could be saved, whereas if they attack the enemy their own men are bound to die. In this instance the Germans did no harm to our ships, but they prevented the Navy from rescuing some hundreds of their own sailors.

In any case the sinking of the *Bismarck* was an excellent example of the happy co-operation which has existed ever since the war began between the Coastal Command of the R.A.F. and the Air Service of the Royal Navy. The *Bismarck* was sunk on May 27th. One Catalina put up a war-service duration record by remaining on patrol for twenty-seven hours non-stop.

MORE ATLANTIC ARRIVALS

By the end of May 1941 a steady stream of American bombers was coming across the Atlantic. Those useful Lockheeds, known as the Hudson, had the ocean crossing to themselves for many months, then an occasional four-engine Boeing of the type called the Flying Fortress came across, after them came the bigger and faster four-engine Consolidated Liberator, a really good aeroplane.

The trouble with the Fortress obviously was that it did not carry enough armament, and that until it was re-designed it could not carry enough to defend itself adequately. Consequently the name Fortress was a mistake. The name implies something which has enough armour as well as armament to be

The 'Bismarck' Affair

proof against attack. But the Boeing had neither. The armament was improved and some of the type did useful work. Its chief feature was that, because it had a turbo-supercharger driven off the exhaust gases from the motor, it could get higher than any of the other bombers, English or U.S.A.

Against this there was the consideration that fitting adequate armament, and gun turrets from which to operate it, meant adding a lot of weight, and a corresponding loss of maximum attainable height—or ceiling, as it is commonly called by people in aviation.

CHAPTER 28

The Invasion of Russia



At 4 a.m. on June 22nd the German Army invaded Russia. Whatever the German Staff may have thought, the German people and the rest of the world expected the Russians to fight hard for a few days and then collapse because of lack of material and organization.

Those of us, in all nations, who know something about the personnel and material of Russian Aviation believed that the Russian Air Force was the biggest in the world, but because of the intensity of Russian propaganda, which defeated its own object, we doubted whether Russian pilots or aeroplanes were of a quality to put up much of a fight.

Nobody doubted the bravery of the individual Russian, for throughout history Russian infantry behind trenches have been as tough as the toughest. Turkish infantry, as our best troops found on the Gallipoli Peninsula, are just about as tough, which is natural seeing that the Anatolian Turk and the southern Russian are of the same breed. But many kinds of Russians are horse-riding people and so there were certain to be a goodly number of competent pilots. The weak point was obviously the construction and maintenance of the machines, and especially of the motors.

Fantastic claims had been made for long-distance flights of Russian bombers during the three or four years before the war. And although some of them were disproved mathematically,

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and explained geographically, the fact remains that the Russians had very many somewhat quaint bombers which could travel long distances.

The fact that the Russians have bombed Berlin several times proves that they still have long-range bombers. But Berlin is much nearer to the Russian frontier than is any part of Great Britain. And an R.A.F. pilot who attacked Berlin from the East dared to suggest, in an Air Ministry communiqué, that he might have been mistaken for a Russian.

By the end of August the Germans had captured an area of Russia which was greater than the area of Germany itself, so the Russian front, if not the frontier, had moved considerably farther from Berlin.

During the first few weeks of the war there was no doubt that the casualties in the air as well as on the ground on both sides were very high. The Russian pilots probably made up by sheer determination for the inferior performance and quality of their aeroplanes.

CALLS FOR MATERIAL

After some six or eight weeks the R.A.F. was called upon to send aeroplanes, presumably fighters, to Russia, and America was called upon for oil, or rather petrol.

These calls struck many people in this country as curious. They asked why a nation of forty-six million people should have to send men as well as machines to a nation of 200 millions, forgetting that we are more or less one people, whereas there are more different breeds and languages in Russia than there are on the whole continent of Europe. And probably masses of the population in the far east of Russia will not have heard of this war till it is over, or if they do hear of it, will think that it is the tail-end of the last war!

The reason for sending petrol to Russia is that although Hitler's attack on Russia was caused ostensibly by his need for oil,

Bombing in This War

Caucasian oil is in fact so bad that it is practically unusable in modern high-compression, high-efficiency aero-motors. Sensitive engines run on petrol from a Caucasian base would knock their heads off, and if enough tetra-ethyl-lead were put into it to stop it from detonating, or knocking, the engine would probably lead-up after a few hours' flying.

Not enough was known at the end of our second year of war about the Russian Air Force to justify my saying anything authoritative about it. But I do know that their twin-motor medium bombers are copies of the Martin bomber which we know as the Maryland. And the Russians have long had four-engine, very large, very slow bombers.

To impress onlookers the Russians have fixed small tanks between the legs of the undercarriages of some of these very big bombers and have transported them across country and landed without breaking anything. But in spite of all the rumours which came to us from Holland and from Crete there is as yet no evidence that tanks have been transported by air in serious operations.

THE BRITISH AIR OFFENSIVE

By the beginning of August 1941, instead of the Germans bombing England, the R.A.F., by now a true International Air Force, had started seriously to bomb Germany at night and to bomb occupied France by day. Our medium bombers, the Blenheims, escorted by quantities of fighters, raided French, Belgian, and Dutch power-stations and factories where our spies told us munitions were being made, unfortunately by French labour. There is no use in blaming the people of the occupied countries for working for the Germans; a conquered people must eat, even out of the hand of the conqueror.

At night our raids on Germany and German munition-centres have been intensified. On July 24th the much-discussed Boeing Flying Fortresses, with four 1,200 h.p. Wright Cyclones,

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went into action experimentally for the first time. They were used in daylight attacks on the German battle-cruiser *Gneisnau* lying in dock at Brest and the assumption was that the machines flew so high that the Germans could not see them, or if seen by high-flying fighters the fighters could not reach them. On this occasion the Fortresses returned undamaged.

A little later, possibly because of some misjudgement of the place at which a machine could be flown at a reasonable height, a Fortress was caught by several German fighters and badly shot up. Several of the crew were killed or wounded, and the machine itself was badly damaged, but managed to get home.

The Short Stirling, the Handley Page Halifax, and the Avro Manchester had also been largely used by the beginning of August, and so far as reports go the very large bombs which these very large aeroplanes carry have had very large effects in Germany. We can only hope that they have destroyed enough factory plant and material to hamper considerably the production of armaments in Germany. Whether the heavier bombing has had any effect on the moral of the German people as a whole remains to be seen.

One fact is evident. It is that because of the size of aeroplanes and the space needed to house them, or even to allow them to stand in the open, and the space which they need in which to get off, any aeroplane takes up so much more space than the area devastated by the bombs which it drops that there is grave doubt whether any country can find aerodrome space from which to start enough aeroplanes to have any decisive effect on the people of the nation which is being bombed.

Here at the end of the second year of war I deliberately make an heretical statement. The bomber and his bombs have the highest weapon-value in striking at another nation, but by themselves they cannot end a war or keep it won.

Everybody knows what huge areas aerodromes cover. Reckon roughly how many aeroplanes can get off a given aerodrome. Then reckon how many bombs those bombers can carry. Then

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reckon how much area can be laid waste by those bombs. Everybody has seen how little damage bombs do in open country, and how quickly bombed roads and railways can be repaired. Therefore to lay waste a whole country by bombing, the attacking air force would seem to need more area for its aerodromes than the area of the country to be devastated.

At the finish the only thing that can win a war is an army with armoured vehicles and aircraft working together, and the only thing to *keep it won* is an army on its own flat feet or on hairy horses or on motor-cycles or in motor-trucks in the enemy's country. That justifies the huge British Army.

To what extent that Army ought to operate under the orders of the Air Force, or whether the Air Force should operate under the orders of the Army, or whether joint or divided control of operations could ever work, gives material for interminable argument. Its introduction will prevent conversation from flagging at any party where the Services are gathered together, and it may end in a free fight.

PART 4

Aerobiographies

*'Let us now praise famous men',
Men of little showing,
For their work continueth
And their work continueth
Broad and deep continueth
Greater than their knowing.*

(RUDYARD KIPLING, *Stalky and Co.*)

Introductory



Readers of all sorts seem to like to know something about famous people with whom they have to deal, or of whose works or products they hear. That is why gossip-writers are so popular among their readers and so unpopular among their acquaintances; they seldom have friends. Readers like to be 'given the low-down', to use an expressive Americanism.

I do not like most gossip-writing, but I do think that the folk who use aeroplanes, or even the mere taxpayer who finds the money for them, may be more interested in their flying or their paying if they know something about the men who make the machines, or who started the businesses which now make them. The way in which some of the businesses grew is amazing and amusing, and I know some stories of them which cannot be told even now.

There is no disputing the fact that these pioneers of flying here and in the United States—and in France and Germany and Italy and Holland—the countries in which the art, science, and sport of flying grew, were and are famous men whose work, as Kipling said, is 'greater than their knowing'.

I know, or have known, the heads of nearly all the big aircraft firms in all those countries, and they *are* big men. There are two or three in this country who, if they took to politics, would make our professional politicians look small. Not only do they know the British working man, who ultimately is the most important person in the country, but they can, when there is need, sway the crowds in their own works with their oratory.

Aerobigraphies

That the head of a big factory should lead his own labour is surely the ideal social condition, and some of these chiefs are real leaders of men. Also they are engineers who, often, can do a job on an aeroplane or an aeromotor better than the workman who is doing it.

Others again are born financiers and business men who have pulled their firms through bad times and have kept their men employed at times when other businesses were crashing round them as if they were being bombed. The man who gives well-paid employment to thousands of others is surely a great man. And yet these are men of little showing, for they do not show off in public the qualities which have made them great.

Let us consider some of those who are responsible for, or who have started, the firms which are making our bombers—the spearhead of our offensive.

AFTERTHOUGHT

*And confident we have the better cause,
Why should we fear the trial?*

MASSINGER (1583–1640).

CHAPTER 29

British Bombers



ARMSTRONG WHITWORTH

Sir W. G. Armstrong Whitworth Aircraft Ltd., Coventry

Sir W. G. Armstrong Whitworth Aircraft Ltd., which makes Whitley bombers, has one of the most curiously complicated histories in the British Aircraft Industry. It runs in two halves and then merges into a different whole.

For a start the Armstrong Whitworth firm of Newcastle-on-Tyne was a great shipbuilding and engineering firm, founded by a Mr. W. G. Armstrong, who became Sir William and endowed the Armstrong College, the Newcastle branch of Durham University. The Whitworth part of it had to do with the standard Whitworth thread, used in all engineering screws, and with Whitworth Scholarships and such things.

In 1913 the directors of Armstrong Whitworth's took a fancy to build aeroplanes, and engaged as designer Mr. Frederick Koolhoven, just cast adrift by the collapse of the British Deperdussin Company Ltd. He designed, before the War 1914-18, the small Armstrong Whitworth biplane with an 80 h.p. Renault air-cooled motor (later used with a Raf motor) and the big Armstrong Whitworth with a 120 h.p. Beardmore water-cooled motor. They were known as the Big and the Little Ack-W. The little Ack-W was the only aeroplane built before the war which was still in use at the time of the Armistice.

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And then, after registering Sir W. G. Armstrong Whitworth Aircraft Ltd. as a separate entity in 1921, Armstrongs stopped making aircraft. Like many of the great engineering firms, A. W. had to reconstruct itself when its inflated war-time output suddenly stopped.

Now for the second part. In the great days of cycling a clever and hard-working young man named John Siddeley came from Manchester and joined the sales department of the Rover Cycle Company Ltd. As soon as motoring began he saw its great future and joined in with Herbert Austin, already known as 'Pa' Austin, who later became Lord Austin, and who died recently. In 1902 'Pa' Austin had induced the Wolseley Sheep-shearing Machine Company Ltd., a branch of Vickers Ltd., to make motor-cars.

From that came the Wolseley-Siddeley car, an excellent vehicle in its time. After a while, as the name of Siddeley became famous, John Siddeley joined with a Captain Deasy and formed the Siddeley-Deasy Motor Company, free from all major industrial influences.

During the War 1914-18 Siddeley-Deasy were asked by the Air Board to make aero-motors. They started by making an air-cooled radial, from which descended the Jaguar, the Leopard and Tiger, and the little Cheetah, which has been built in thousands for the Avro Ansons. The designs of these were largely influenced by Signor Viale, a clever Italian engineer, who had made engines of his own before the war. Also the Siddeley-Deasy firm took over the B.H.P. (Beardmore-Halford-Pullinger) six-cylinder, in-line, water-cooled, 200 h.p., and made it into the Siddeley Puma, which kept the D.H.9 bomber going for years, and did much civil flying up to 1924 or so.

The firm became Siddeley Motors Ltd., and made aeroplanes during the war. From them came the Siddeley Siskin single-seat fighter, which was a standard type in the R.A.F. for some years.

When the great Armstrong Whitworth company was recon-

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structed, Sir John Siddeley, as he had become, was a member of the committee of shareholders appointed to oversee the business. He made an offer to buy the title of Sir W. G. Armstrong Whitworth Aircraft Ltd. And so the Armstrong-Siddeley business, which made excellent cars, and tanks, with Wilson pre-selector gear-boxes, and aero-motors and aeroplanes, came into being.

During the war Mr. J. Lloyd, from the Royal Aircraft Factory, joined the Siddeley company as designer, and he has been in charge of design ever since. He produced some of our best-known civil aeroplanes for Imperial Airways Ltd.—the Argosy biplane with three Jaguars, and a monoplane with four two-row Mongoose motors, and lastly the great Ensign with four 850 h.p. Tigers, which as they were not powerful enough for it, has now been given four American motors of some 1,200 h.p. each. The type is now doing very well.

In 1935 the Hawker-Siddeley Aircraft Company Ltd. was formed by Mr. Philip Hill's financial group to amalgamate the Hawker and Siddeley interests. After a year or so Lord Kenilworth (as Sir John Siddeley had become) resigned, and the whole outfit came into the able hands of Sir Frank Spriggs, Mr. H. K. Jones, and Mr. T. O. M. Sopwith, of the old original Sopwith company, who later formed the H. G. Hawker Engineering Company Ltd., which in turn became Hawker Aircraft Ltd.

They are definitely the most dominant group in the British Aircraft Industry to-day. Sir Frank has been for two years President of the Society of British Aircraft Constructors, and the group controls the Avro and Hawker and Gloster firms.

The Whitley appeared at first with two Siddeley Tigers of 850 h.p. each, and with them was used for bomphleteering over Germany during the Sitzkrieg in the winter of 1939-40. But before war began the R.A.F. knew that the power was too low for the range and bomb-load which they wanted the Whitley to carry, so Rolls-Royce motors were fitted, and there is now a

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saying in the R.A.F. that nobody has yet discovered the load which will stop a Whitley from taking off if it has the power. A fact of which Mr. Woodhams, who is chief of production, may well be proud.

When serious bombing began the Mark IV Whitley with two Rolls-Royce Mark IV Merlins, of 1,030 h.p. each, were put into service. With them it had a top speed of 245 m.p.h., a cruising speed of 215 m.p.h., a maximum range of 1,800 miles, and a service ceiling of 23,000 feet.

All these figures have been much improved in the Mark V, which has Merlin Mark X motors of 1,100 h.p. or more.

The dimensions are: span 84 ft., length 70 ft. 6 in., height 15 ft. Mean chord, 14 ft. 4 in. Wing area, 1,137 sq. ft.

AVROS

A. V. Roe & Co. Ltd., Newton Heath, Manchester

A. V. Roe & Company Ltd. is one of those aircraft firms which I can never place alphabetically with a clear conscience. Obviously they ought to go under R for Roe. But everybody calls them 'the Avro people' and Sir Alliott Verdon-Roe is never called anything but Avro by his friends. So what can one do but put them under A? And anyhow they are about the oldest firm in the trade.

A. V. Roe was a marine engineer as a young man—hear him tell tales of scraps in the stoke-holes of coal-fired steamers with Afghan firemen! But somehow he became infected with aviation, and took to making models, one of which won him a prize at the Crystal Palace in the Dark Ages before 1908.

His father, Dr. Roe, of Putney, financed the building of his first man-size aeroplane. It was a strange pusher monoplane which hopped along the finishing-straight at Brooklands Track in 1908, and gave Avro a fair claim to have been the first man to fly in England and the first Englishman to fly. Competing evidence suggests that S. F. Cody may have made a hop off Laf-

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fan's Plain, Aldershot, a day or two earlier, but, anyhow, he was a citizen of the U.S.A.

To settle the matter the Royal Aero Club held an inquest, or an inquisition—it was far more searching than an inquiry. They decided that a hop is not a flight, and that the first Englishman to fly in England was J. T. C. Moore-Brabazon, a Norman-Irishman, on a French aeroplane. So he is Pilot No. 1 in the Royal Aero Club's list. Later he became Lieut.-Colonel, R.F.C. and R.A.F., M.C., M.P., and Minister of Aircraft Production.

Avro's flight ended in a crack-up and the pieces were swept from Brooklands with scorn. So he betook himself to Lea Marshes, London, very much E. How these poverty-stricken pioneers were driven to the waste places of the earth will be seen in the stories of others. There he was joined by E. B. Fisher and Howard Flanders, both now dead, whose names deserve to be remembered.

Thereafter Avro's brother Humphrey came and helped. He had been an officer in the Manchester Regiment during the Boer War, and served through the siege of Ladysmith. Afterwards he acquired a firm called Everett & Company in Manchester, which made webbing, and specialized on 'Bull's-Eye Braces'. He also acquired John Lord, one of the greatest characters in the Aircraft Industry, a Lancashire man of the finest type.

A. V. Roe & Company was formed and the firm moved to Wembley, where was the remains of a tower which was to have beaten Eiffel's. There, if I remember rightly, Roy Chadwick and R. J. Parrott joined Avro. Parrott was a fine engineer. He died on the 11th of September 1941, at the age of fifty-four, much lamented by many friends.

Thence, when H. V. Roe had financed the firm, they moved back in 1910 and in triumph to Brooklands, where Major Lindsay Lloyd was making a proper aerodrome inside the motor track. First they built a tractor triplane with a 35 h.p. Green engine, then a biplane with the same engine. In it several

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notable officers of the British Army learned to fly. Then came a bigger biplane with an E.N.V. engine.

Then came a biplane with a 50 h.p. Gnôme rotary radial, and that was the beginning of success. The Royal Flying Corps ordered a dozen of them. Until then the saying at Brooklands was that Avro Biplanes were kept up by Bull's-eye Braces. After that the R.F.C. supported them and the Avro biplane kept the R.F.C. in the air.

At the opening of the great Military Aeroplane Competition (its official title) in 1912, before any of the British and foreign professional pilots of the many competing firms were allowed to fly, a 50 h.p. Avro was sent up to test the air. It was piloted by Captain R. H. M. Brooke-Popham—now Air Chief Marshal Sir Robert Brooke-Popham, G.C.V.O., K.C.B., C.M.G., D.S.O., A.F.C., Governor of Singapore and Commander-in-Chief of all British Forces in the Far East, with H.Q. at Singapore.

In 1913 A. V. Roe & Company was registered as a Limited Company. By 1914 the Avro Type 504 biplane had arrived. From it evolved the 504K with a 100 h.p. monosoupape Gnôme, which became the standard trainer of the R.N.A.S. and R.F.C., and later of the R.A.F. With the 120 h.p. le Rhône or Clergêt it went on after the War 1914–18 to become the basic trainer of almost every country except Germany, France, Italy, and Holland, which designed their own.

During the War 1914–18 the firm took over part of Mather & Platt's factory in Manchester. Avro himself and Roy Chadwick, who by then had become Chief Designer, and still is after nearly thirty years, had ambitions beyond making trainers. So they made, during 1917–18, several interesting experimental twin-motor biplane bombers. One of them, the Pike, had twin pusher-screws and was particularly promising. It had B.H.P. (Beardmore-Halford-Pullinger) engines, designed by very young Major Halford, who has since given us the Cirrus, and the D.H. Gipsy and the Napier Rapier and the Dagger, and lately the

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great Sabre of 2,300 h.p.—the most powerful aero-motor in any country at this date.

The Pike introduced to the air community another Avro character. A youngster named Dobson had come up to town from the Avro Manchester works to help in the assembly and testing of machines delivered to Brooklands and to the new Avro Works at Hamble on Southampton Water. He used to fly on test as passenger with Fred Raynham, the firm's test pilot, so of course he went up in the Pike, in the aft gunner's seat. The pilot sat just level with the front spars. The front gunner sat out in a long nose, to balance the engines which were on the aft spars, because of the pusher screws.

The machine took off well and climbed steeply. Raynham pushed the stick forward to fly level and the tail refused to come up. The machine just went on climbing. Then he realized that he had no gunner and guns forward, and solid little Dobby was in the back seat, and the tail never would come up. He looked back and signalled to Dobby what was the matter—there were no telephones in those days—and put the machine into a steep bank to make it turn on its own climb, as it were, hoping that he might slip it down sideways, or, at any rate stop it from going so high that it would stall and fall out of the sky all anyhow.

The gallant Dobson, seeing what was needed, at once climbed out of the gun-pit, straddled the narrow fuselage, and, without hand-hold, jockeyed himself along the several feet of convex decking between him and the centre-section struts. This was the more difficult because the propeller-tips came within inches of the fuselage and missed his feet by no more.

When he reached the centre section he crawled between the cross-bracing wires, climbed over Raynham's head, and, according to Raynham, took a header into the front gun-pit, regardless of how he was going to come right side up. Anyhow he got there, and the balance was restored and the tests went on according to plan. But people have got medals for less.

To-day Mr. R. M. Dobson is Manager of all Avro work in

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the North Country, with H.Q. in the Manchester Area. Of which there is a good story. The Avro works naturally have a fleet of cars rushing from one sub-contractor or satellite workshop to another. And Dobson decided that there was no use in having a beautifully camouflaged H.Q. if it were surrounded by a park full of bright and shiny cars. So he ordained that all works' cars should line up one morning outside the works and be spray-painted.

Half a dozen or so had lined up when an exalted official of the Air Ministry arrived in a spanking new car, a Rolls or Bentley or something high class, and parked it in the ordered rank. An hour or two later he came out, and could not find his car in a queue of several dozen camouflaged motors of all sorts and sizes. Nobody had told the spray-painter to differentiate. I will not swear to the whole truth of the story, but that is it in substance.

At Manchester Dobson has made hundreds and hundreds of Avro Ansons, and lots of Blenheims, and more Ansons, and more lately the original Manchester, our biggest twin-motor bomber—a credit to Roy Chadwick's design department. And of course, as everything is bigger and better and brighter, there are naturally still newer types arriving.

The financial history of A. V. Roe & Company Ltd. is interesting. In 1916 more finance was needed, so the Groves family, the big Manchester brewers, came in. They bought H. V. Roe out, and he joined the R.A.F., though well over forty years of age, and was crashed in the Vosges, while serving with General Trenchard's Independent Force.

After the war Crossley Motors Ltd. acquired control. They sold out to Sir John Siddeley, now Lord Kenilworth. A. V. Roe and John Lord resigned, joined Sam Sanders of Cowes, and formed Saunders-Roe Limited. I grieve to state that Sir Alliott Roe's eldest son Eric, a very charming young man in his early twenties, and already a squadron-leader R.A.F., was recorded as missing in July 1941. He was on his last raid on Germany,

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he had done about twenty-five or thirty, and was due for a rest. His machine was badly shot about. On the way home, fifty miles from the coast of Holland, his wireless man reported that they would have to bale out, as they were going down into the sea. Nothing has been heard of any of the crew since then.

Sir John Siddeley formed the Armstrong-Siddeley combine. And that, in turn, was taken over by the Hawker group, in which Mr. Philip Hill, Sir Frank Spriggs, Mr. T. O. M. Sopwith, and Mr. H. K. Jones are the moving spirits. And like all the activities of that group, it is flourishing.

BLACKBURNS

The Blackburn Aircraft Company, Ltd., Brough, East Yorks.

Robert Blackburn began experimenting with flying-machines early in 1908. Like other pioneers, he had to do it in the waste places of the earth, but instead of going to marshes or dumps he had the long stretches of beach at Filey in Yorkshire, later a popular seaside resort. There he hopped in strange contraptions, and from them in 1910 he developed a handsome type of monoplane, rather like the historic French Antoinette.

Bob Blackburn's monoplanes became famous through the perigrinations of Lieutenant Spenser Grey, R.N., one of the Navy's pioneers; Benny Hucks, one of our best pre-war pilots; Dr. M. G. Christie, later a famous war-pilot and a post-war Air Attaché in Washington and in Berlin; Harold Blackburn, no relation to Bob; Conway Jenkins, later a Brigadier-General, R.F.C., and others.

When war began in 1914 the Blackburn Company was well established at works in Leeds, and during that war they made many types of aeroplanes in their new huge works at Brough on the Humber, among them the Kangaroo, a twin-engined bi-plane with an immensely long nose, which was one of our first torpedo-droppers.

After that war the firm made mostly machines for the Fleet

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Air Arm, some of fantastic design to meet the Navy's ideas. Also they built some very fine flying-boats. In the years from 1935 to 1939 they had supplied quantities of their Shark torpedo-reconnaissance-bomber biplane to the Fleet Air Arm and to various foreign nations. As a side-line they ran the Greek Government's Naval Aircraft Factory at Phaleron on the bay near Athens.

Their last products before the war were the Skua in 1937, monoplane ship-board dive-bomber, built to the requirements of the Fleet Air Arm, and, in 1938, a variant of it, on a bigger scale, called the Roc, built by Boulton-Paul Aircraft Ltd. at Wolverhampton. The Skuas have done a lot of flying during the war as scouts and in attacks on enemy shipping, from aircraft-carriers and from R.N. Air Stations ashore.

Here are such figures as are available.

Skua: 905 h.p. Bristol Perseus XII, sleeve-valve radial. Span 46 ft. 2 in., length 35 ft. 4½ in., height 12 ft. 6 in., width folded 15 ft. 6 in. Weight empty, 5,847 lb.

Performance: top speed, at 6,500 ft., 225 m.p.h.; at sea level, 204 m.p.h.; cruising at 15,000 ft., 187 m.p.h.; landing speed, 75 m.p.h.

THE BRISTOLS

The Bristol Aeroplane Company Ltd., Filton, Bristol

In the predecessor to this book, *British Fighter Planes*, I gave a sketch of the pedigree of the Bristol aircraft, but I must do so again. The British and Colonial Aeroplane Company Ltd., generally known as the Bristol Company, and often as the Bristol Co., was registered by Sir George White, one of the most eminent of Bristol's Merchant Venturers, in 1910.

He had become the tramway King of Great Britain by buying up every horsed tramway in sight and electrifying it. Then he gave the City of Bristol the best motor-bus and taxi service in the Empire, and his bus services soon spread like an octopus

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all over the West Country. So naturally he saw the possibilities of air transport and of airway.

To his new company came Frank Barnwell, a Clyde-trained engineer, who, with his brother Harold, had built and cracked up an aeroplane of their own in Scotland. Harold went to Vickers Ltd. Frank joined in 1910 and designed all the worthwhile Bristols from 1912 until his death in 1939.

His first-fruit, the little Bristol Bullet of 1913, competitor with the Sopwith Tabloid, did 90 m.p.h. with a 50 h.p. Gnome rotary engine, and by 1914 it was standard equipment in the Royal Flying Corps. On the outbreak of war in August 1914 Frank Barnwell, a Captain in the Reserve of the R.F.C. went to France, but was brought back and told to go on making aeroplanes. Which was wise.

In 1916 he produced a monoplane which many good pilots said was the best single-seater in the war. It was condemned as dangerous by a senior officer who did not know how to land. But Barnwell came into his own in 1917 with the Bristol Fighter, commonly known as the Brisfit.

Primarily it was a two-seat fighter. The pilot and passenger sat back to back, the latter with a gun (later twin guns) on a Scarff ring. Its Rolls-Royce Falcon motor of 275 h.p. was reliable, the machine was excellent, and it could carry bombs, so it became a legend of weapon-value in the R.F.C. No other machine has such a long record of good service.

After that war it was still used for bombing on the N.W. Frontier of India. But loaded with bombs or beer, and getting off or landing in air out of which all the lift had been stewed, it acquired a reputation for stalling and spinning into the ground. Group Captain Adrian Chamier, after commanding in India, came home to be Director of Technical Development at the Air Ministry in about 1923. Promptly he ordered that all Brisfits should be fitted with Handley Page Slots. Thus he saved many lives. Slots might have saved many hundreds more lives if designers of all nations had used them properly.

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Between 1918 and 1935 Frank Barnwell designed many good and interesting machines, but his next big success came with the Blenheim in the latter year. It happened thus.

Frank Barnwell had designed and built an all-metal fuselage for a twin bomber or high speed transport plane. Lord Beaverbrook had bought a Lockheed ten-seater and flew around quite a lot in it. Lord Rothermere not to be outdone, sent out envoys to find something British to match it. They found at the Paris Aero Show of 1935 the fuselage of a new all-metal Bristol twin-motor low-wing monoplane. And Lord Rothermere said that he would buy the machine when it was finished.

Instead of using it himself, he presented it to the Air Ministry—presumably in memory of the fact that he had been our first Air Minister, January to April 1918. He called it 'Britain First'—which rather suggested 'After you, sir', or 'Thy need is greater than mine'.

The Air Ministry ordered Barnwell's revised version of 1936, a mid-wing monoplane with two Bristol Mercury motors of 920 h.p. It was named the Blenheim. This was intended to be a self-defending medium bomber, with twin guns on deck amidships and twin guns in the nose. For that date it was very fast—it did 230 m.p.h.

By the end of 1939, by experiments with streamlining, a standard model had been worked up to 300 m.p.h. Since then the Blenheim has been made into a long-range fighter, a night-fighter, a coastal bomber, and a daylight bomber, besides being used as a dive-bomber during the rout of the French Army.

Frank Barnwell was killed in 1938 in an accident to a small low-powered monoplane which he had built for his own amusement. He had always said that his ideal was the biggest possible engine with the smallest possible aeroplane behind it. The machine in which he died had just enough power to take him high enough to kill him. His death deprived this country of one of its great pioneers and one of its best designers, and those of us who knew him well lost a very dear friend. The tragedy of

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the Barnwell family is made the greater by the fact that his three sons have been killed in the Air Force in this war, and his brother Harold was killed while flying in 1918.

His successors, Messrs. Frise and Pollard, formerly his assistants, have worthily carried on his work. Their Beaufort torpedo-bomber has been highly successful as a torpedo-carrier and as a bomber. Naturally its performance-figures cannot be given. But it has two Bristol Taurus sleeve-valve engines of 1,065 h.p. each, so it is notably fast.

The Beaufighter is strictly a fighter, but it is much of a size with the Beaufort, so for comparison its dimensions may be given. It has had great success as a night-fighter and has been built in large quantities with more and more powerful motors.

Hereafter are such figures as may be published.

The Blenheim, Mark IV: two 920 h.p. Mercury XV engines. Span 56 ft. 5 in., length 42 ft. 9 in., height 9 ft. 10 in. Wing area, 469 sq. ft.

Weight empty, 8,100 lb. Service load, including 278 gallons of fuel and 17 gallons of oil, 4,400 lb. Weight fully loaded, 12,500 lb.

Performance: top speed at sea-level, 240 m.p.h.; at 20,000 ft., 295 m.p.h.; service ceiling, 29,000 ft. (approximately); range, 1,900 miles; landing speed, about 50 m.p.h.

The Beaufort: two 1,065 h.p. Bristol Taurus sleeve-valve radial engines. Span 57 ft. 10 in., length 44 ft. 2 in., height 14 ft. 3 in.

The Beaufighter: two 1,435 h.p. Bristol Hercules, fourteen-cylinder, two-row sleeve-valve radial engines. All-up weight, 21,000 lb. Power-loading, 7.45 lb. per h.p. Disposable load, 52 per cent of empty weight. Fuel load, 550 gallons of petrol.

Span 57 ft. 10 in., length 41 ft. 4 in., height 15 ft. 10 in. Wing area, 451 sq. ft.

Speed (nominal), 330 m.p.h.; range, 1,500 miles; service ceiling, 29,000 ft.

Armament, four British-made shell-guns of Oerlikon-His-

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pano type, in nose, plus six Browning guns (of 1,200 rounds per minute) in wings.

THE FAIREYS

The Fairey Aviation Company Ltd., Hayes, Middlesex

Charles Richard Fairey, as recorded in *British Fighter Planes*, the forerunner of this book, came into aviation when he was a young lecturer on science at the Finchley Polytechnic, because he was interested in flying models and particularly in the problems of inherent stability. Through that he came in touch with Mr. J. W. Dunne of the Middlesex Regiment, who had done much experimenting with an inherently stable glider at Blair Athol and was then building a power-driven version at Eastchurch. Mr. Dunne later wrote that famous book *An Experiment in Time*.

Fairey joined Dunne at Eastchurch, where the Navy's earliest aviators were at work (see the notes on Short Brothers), and so became friendly with all the Air Department at the Admiralty. He joined Short Bros. as Works Manager in 1913.

Early in 1915 a group of financiers started him in business as the Fairey Aviation Company Ltd., but not long after he became sole proprietor, and since then the Fairey Company has been one of the great firms of the British Aircraft Industry. Throughout its life the Fairey Company has specialized on sea-going aircraft.

Although at one time there were more Fairey machines in the R.A.F. than there were of all other types put together, and although the Fairey Fox of 1926 set the fashion in the general lines of all our modern aeroplanes, Mr. Fairey has always had a hankering after the sea-going trade, and has kept a big proportion of the orders for the Fleet Air Arm. And when the Fleet Air Arm was returned to the Navy early in 1939 and again became the Royal Naval Air Service he kept that trade.

Consequently when this war began the Navy's torpedo-

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bomber-reconnaissance machines were mostly Fairey Swordfish. And soon quantities of Fairey Albacores, a much improved type of biplane, came into the Navy.

These machines have won most of the honours of the Naval Air Service. Swordfish carried the parachute-mines which were laid round the coast of Denmark and far up into the Baltic while the Germans were occupying Norway. Swordfish and Albacores bombed and torpedoed the Italian Fleet at Taranto. Swordfish from aircraft-carriers in mid-Atlantic tracked the *Bismarck*, and either Swordfish or Albacores launched the torpedoes which slowed the ship so that our heavy ships came up with her. Likewise torpedoes from these aircraft slowed the fast Italian ships at the battle of Cape Matapan, so that our ships could catch and destroy them.

The following figures are available:

Swordfish: one 690 h.p. Bristol Pegasus III M3 motor. Span 45 ft. 6 in.; width folded, 17 ft. 2 in. Length on wheels, 36 ft 4 in.; on floats, 40 ft. 11 in. Height on wheels, 12 ft. 10 in.; on floats, 14 ft. 7 in.

Weight empty, 4,195 lb. Service load, 1,900 lb. All-up weight, 7,720 lb.

Performance: top speed, 154 m.p.h.; cruising, 131 m.p.h.; stalling speed, 67 m.p.h.; service ceiling, 19,250 ft.; duration, 5-7 hrs.

Albacore: one 1,065 h.p. Bristol II Taurus engine. Span 50 ft. Length on wheels, 39 ft. 10 in.; on floats, 42 ft. 5½ in. Height on wheels, 14 ft. 2 in.; on floats, 17 ft. 9 in.

No performance figures available.

HANDLEY PAGE

Handley Page Ltd., Cricklewood, N.W.2

Ever since I first met Mr. Frederick Handley Page, early in 1909, he has been a worry to me, because I have never been able to decide whether to put him alphabetically under H for Hand-

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ley or P for Page. In fact he is a Problem Page in many ways, for there are three of him, all quite distinct personalities.

(a) There is Freddy Page, as good a friend as one could wish to have; a perfect host, an admirable father of a charming family, a brilliant and well-read conversationalist with an intimate knowledge of the Scriptures, an expert parlour conjuror, and a first-class humorist.

(b) There is H. P.—one of our leading and most versatile aeronautical scientists and a great engineer; a man who is equally able to criticize constructively the work of a high-brow design staff or to supervise the building, re-arrangement, or re-organization of a great factory employing thousands of men, or to judge the workmanship of a riveter or a fitter; a great asset to this country, who has given us some of our best aircraft, and, in the H. P. Slot, the greatest life-saving device the science of aeronautics has produced.

(c) There is Mr. F. Handley Page, the managerial and financial head of some of the biggest affairs in the Aircraft Industry; a notable public speaker; the originator of that colossal financial deal after the last war, the Aircraft Disposal Company Ltd., which handed some £6,000,000 to the Government out of what was in effect a scrap-heap and himself paid some hundreds of thousands of pounds in Income Tax on the deal, at a time when the Tax was only a few shillings in the pound; a man who has made millions for others, whatever he has made for himself; and a man who is good to work with, but who takes more watching than most people if one is so ill-judged as to get up against him.

Altogether H. P. is a remarkable personality. I could write a book about him and his work. But here we are concerned with his aeroplanes, and as they all begin with an H, he must come there alphabetically.

I first met H. P. in his works at Barking—a tin-and-timber shack on top of the dump-heaps which had grown from the boring of the London tube railways. He was already Handley

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Page Ltd. H. P. had brains but no money, and the rent on dump-heaps was low. He had started as a general engineer in a small way. At that time he was also lecturing at the Northampton Polytechnic in Clerkenwell, a place where intelligent young workpeople really learned things. In his shack he made strange contraptions for wild air inventors who could afford to pay for their foibles, and he used the money to build his own idea of an aeroplane.

His first was a tractor monoplane which had back-swept wings, thick in the centre-section, and tapered up-swept tips—like a neat version of the early Etrich Taube (or Dove), which, as a standard German Army type in 1914, our troops inevitably called the 'Tawb'. H. P.'s. had a rather temperamental Anzani stationary radial motor of about 50 h.p. (I think), so that it flew at odd times—but it flew. Because of its colour it was known as *The Yellow Peril*. It appeared at our Aero Show in 1910.

From Barking H. P. Ltd. moved to a place called Fairlop, somewhere near Gidea Park, in an area which is mostly under London smoke and is only clear when there is an east wind—which kept its rent down. In spite of good advice the Corporation of the City of London was persuaded, in about 1938, to acquire the site for the City's projected aerodrome—a place which, because of the road traffic, is no easier to reach than Heston or Croydon from the Bank or Liverpool Street. But H. P. had nothing to do with that.

At Fairlop he made a monoplane which was, accidentally, still more offensively coloured, and so was called *The Antiseptic*, but it flew quite well. Then he made a back-swept, up-swept biplane which flew so well that we forgot to give it a nickname. It performed regularly in 1914 at the Hendon Aerodrome, then a show-place where Richard Gates and Bernard Isaac, who ran it, thought they had a bad week-end if the gates were less than 25,000 people, and reckoned on 200,000 or so on-lookers for an Aerial Derby or King's Cup Race.

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Then came the war. H. P., like others of the more acute aeroplane-builders (one could not call them manufacturers then), had been playing up to the Air Department at the Admiralty which controlled the Royal Naval Air Service and was encouraging original Trade designs, as opposed to the policy of the War Office's Department of Military Aeronautics, which was under the thumb of the Civil Servants of the bureaucratic Royal Aircraft Factory at Farnborough and had already standardized the disastrous B.E. series of biplanes.

In December 1914 the Air Department at the Admiralty suggested to H. P. that he should build a machine which would carry an effective load of bombs—he was already busy building B.E.s as a stop-gap type for the R.N.A.S., and had acquired works at Cricklewood, where he remained. These ultimately extended to the great sheds which many people know as the Armstrong-Siddeley Service Depot. And he commandeered, with the Admiralty's help, from the Ecclesiastical Commissioners (the toughest of landowners to persuade about anything) a great area of farmland for an aerodrome. It is now cut up by the Hendon By-Pass and the streets which turn off it.

H. P.'s design-staff, urged and advised by H. P. himself, and enthusiastically backed by the Works, produced during the next year, a twin-motor biplane called the 0/100. It made its first flight on the 18th of December 1915. It was extraordinarily stable, easy to control, and could fly with only one motor. It could carry more than a ton of bombs—and the petrol-tanks and part of the fuselage were protected by armour plating.

This was the machine of which Rear-Admiral Sir Murray Sueter, M.P., spoke so enthusiastically in 1940, when, on some public occasion, he related how Mr. Handley Page had been brought to see him at the Admiralty and he at sight made up his mind that here was the man to deliver the goods—and he did.

I must note again here how much the Empire owes to Sir Murray Sueter and his little gang of pirates in the Air Department at the Admiralty, notably his four Engineer-Officers—

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Engineer-Lieuts. Featherstone Briggs, Charles Randall, Gerald Aldwell, and Wilfred Briggs, for encouraging new ideas and new men and new types in the Trade when the Royal Flying Corps was doing its best to standardize everything and stifle originality.

During 1916 the 0/100 was modified, became the 0/400 and was being built in quantities. The Rolls-Royce engines had been much developed and were giving some 350 h.p. The armour had been removed and the tanks put into the fuselage, instead of being behind the engines.

Much of the credit for the flying qualities of the 0/400 was due to Flt.-Lieut. John Babington, R.N. (now Air-Marshal, lately commanding at Singapore), who was one of the finest pilots in the R.N.A.S., and had already won the D.S.O. in the raid on Friedrichshafen. He did nearly all the preliminary flying tests, and suggested many improvements.

The first went to France in January 1917, and, as told earlier in this book, was promptly presented to the Germans. But by October 1917 forty of them had gone to France and were doing good work, mostly from Coudekerque Aerodrome, near Dunkerque (to spell it properly).

Early in 1917 an 0/400 flew from England to Mudros, the Aegean base of the Royal Naval Air Service unit which was operating in the Northern Levant. Thence it raided Constantinople, Adrianople, and other Turkish and Bulgarian towns. The raids on Constantinople were particularly noteworthy in that the machine had to fly 440 miles mostly over sea or hostile territory.

Later on the new Air Ministry released another of the 0/400's for service in the Middle East, and in the summer of 1918 it flew out to Palestine in time to take a prominent part in General Allenby's offensive which annihilated the Turkish 7th Army. Previously Colonel Lawrence had borrowed the machine to co-operate with his Arabs on the Eastern flank.

When Major-General Sir Hugh Trenchard formed the Inde-

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pendent Force R.A.F., at Luxeuil, near Nancy, a squadron of 0/400's was used very effectively against the Rhineland cities, largely at night—and just remember that there were no blind-flying instruments and no parachutes in those days. By the end of the War 600 of the 0/400's had been ordered.

During 1917 Handley Page Ltd. was also busy turning out a huge four-motor biplane to bomb Berlin. This was called the V/1500. It had four Rolls-Royce Eagles of 375 h.p. each (1,500 in all) and it carried 6·5 tons of useful load.

Its span was 126 ft., length 64 ft., height 25 ft. Top speed, 100 m.p.h.; cruising speed, 90 m.p.h.; duration, 12 hours. Weight empty, 16,000 lb.; weight fully-loaded, 30,000 lb. Petrol tankage, 1,000 gallons.

It could carry thirty bombs of 250 lb. each—three tons and a bit of bombs was not so bad twenty-four years ago—with a range of 1,000 miles.

The first V/1500 flew in May 1918. Altogether 255 of them were ordered. Some were built by Harland & Wolff, the Belfast shipbuilders. One of them carried forty passengers over London. The pilot was a great little American sportsman named Clifford Prodger. He was America's only contribution to the production of big bombers during the War 1914–18, and his reports helped greatly in the improvement of the machines.

When the Armistice was signed three of these machines were standing by at Bircham Newton, in Norfolk, ready to bomb Berlin. The officer commanding was a Canadian, Lieut.-Colonel R. H. Mulock, R.A.F. (Wing-Commander 'Red' Mulock, R.N.A.S.), now a big noise in the Canadian Car & Foundry Company of Montreal.

After the Armistice Major-General Geoffrey Salmond, who was commanding the R.A.F. in the Middle East, decided to inspect the Units in 'Iraq. So on November 29th, with Air Commodore Amyas Borton and Captain Ross Smith (later made Sir Ross for his flight to Australia with his brother Keith) and two mechanics, General Salmond left Heliopolis Aerodrome,

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Cairo, in an 0/400. The same afternoon they reached Damascus. At 7.25 next morning they started across the desert. They arrived at Baghdad at 3.30 on December 1st.

Later they went on to Karachi, and thence across India to Calcutta, to study the possibility of a flight from England to Australia—much to the benefit of Ross Smith.

In the meantime the Afghan war had broken out and a super-bomber was wanted to attack Kabul. Thus, shortly after the end of the war in 1918, a V/1500, piloted by Major McLaren and Major Halley, with Colonel McEwen in command, left England to fly to India. Two notable non-stop flights were made. The first was over the sea from Malta to Egypt and the second across the desert from Cairo to Baghdad.

The raid on Kabul was made with decisive effect—that was when Jock Halley blew out the walls of the King's harem and started the fashion of female emancipation in Afghanistan.

A V/1500 was also sent by ship to Newfoundland to fly the Atlantic. The pilots were Major H. G. Brackley, D.S.O., and Major Trygve Gran, D.S.O. (a Norwegian), with Admiral Mark Kerr in charge. This machine never started the Atlantic crossing because Alcock and Brown did it first, but it flew a lot both in Canada and the U.S.

The next type of Handley Page bomber to be produced was the Hyderabad in 1923. Many of these were used by the R.A.F.

The Hyderabad was a military version and a further development of the commercial Type W.8 which won the Air Ministry Civil Aeroplane Competition of 1920, and with either Napier Lion or Rolls-Royce engines, played a leading part in the early days of Air Transport in this country, and was operated in considerable numbers by Imperial Airways.

An improved version of this, known as the Hinaidi, and fitted with Bristol Jupiter engines instead of the Napier Lions, made its first appearance in the New Type parade at the R.A.F. Display of 1927. This also became a standard night-bomber of the Service.

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The first Hinaidi was produced in 1927. This was subsequently produced as an all-metal structure with fabric covering.

Then came the Heyford—a curious biplane in which the fuselage was built onto the upper plane, partly to give a big angle to the wings in starting and landing, so that the slots could have their full effect, and partly to give the crew a clear outlook above against attack. It looked rather like a Virginia flying on its back when seen head on in the air, or so R.A.F. pilots said. But it was a good aeroplane in its day.

Afterwards came the Harrow—more ordinary in appearance—it was a good-looking big monoplane—and it had a top speed of 200 m.p.h., which was remarkable for a bomber. It was obsolete when this war began, and it had been replaced by the Hampden—one of the most highly efficient bombers in the world, and only beaten on figures by its descendant the Halifax.

The chief figures for the Handley Page series up to the Harrow are as follows:

Performance Figures

O/400: 2 Rolls-Royce Eagle VIIIs, 375 h.p. each. Speed, 95 m.p.h. Load, sixteen 112 lb. bombs.

V/1500: 4 Rolls-Royces, 375 h.p. each. Span 126 ft. Area, 2,880 sq. ft. Tankage, 1,000 galls. All-up weight, 30,000 lb. Top speed, 100 m.p.h. Bomb load to Berlin and back, 1,000 lb.

Hyderabad: 2 Napier Lions, 450 h.p. each. Span 75 ft. Area, 1,482 sq. ft. All-up weight, 12,500 lb. Speed, 120 m.p.h.

Hinaidi: 2 Jupiter VIIIs. Span 75 ft. All-up weight, 13,200 lb. Range, 850 miles. Speed, 122 m.p.h.

Heyford: 2 Rolls-Royce Kestrel IIIs. Span 75 ft. All-up weight, 16,750 lb. Range, 920 miles. Speed, 145 m.p.h.

Harrow: 2 Pegasus Xs. Span, 85 ft. 5 in. Area, 1,090 sq. ft. All-up weight, loaded, 23,000 lb. Top speed, 200 m.p.h. Range, 1,880 miles.

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The Hampden

After the Harrow came the Hampden, classed as a medium bomber along with the Blenheim. It is one of the best aeroplanes ever built. It was the joint product of Dr. Lachmann (now interned) the slot specialist, Mr. Volkert the design chief, and Mr. James Hamilton, the Works Manager, a great man on production.

As a flying machine the Hampden is excellent. Its weight-lifting capacity, for its speed and power, is extraordinary. But perhaps its chief attraction is the speed with which it can be built.

The fuselage is built split longitudinally—like a split lobster. All the 'guts' so to speak, electric wiring, hydraulic lines, clips and fittings for accessories are built in, and then the two halves are joined up and rivetted. A dozen men can work on each half at a time, whereas if the fuselage were built in one piece, not more than one man at a time could work inside it.

Also the tail unit, wings, engine-housings, and fore-part are built as separate units and are only joined (or married, as they call it in the shops) when the whole lot are together in the assembly plant.

As the Hampden was flying before the war we can publish most of its figures. These are as follows: span 69 ft. 2 in., length 53 ft. 7 in., height 14 ft. 11 in. Chord, at root, 16 ft. 3 in.; at top, 3 ft. 10 in.

Weight empty, 11,780 lb.; fuel, 3,173 lb.; oil, 216 lb.; service load, including crew, 3,587 lb.; weight loaded, 18,756 lb.; maximum permissible loaded weight, 21,000 lb.

Power Plant: two Bristol Pegasus XVIII motors of 980 h.p. each.

Top speed (loaded to 18,750 lb.) at 15,500 ft., 265 m.p.h.; cruising speed 217 m.p.h.; landing speed, 73 m.p.h.; service ceiling, 22,700 ft.; range with service load, 2,587 lb., 1,475 miles.

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If loaded to 21,000 lb. with service load of 3,587 lb. and running at 1,800 r.p.m. instead of the normal 2,250 r.p.m. the Hampden can achieve a range of 1,990 miles.

The one drawback to the Hampden is the fact that the fuselage is only wide enough for one man, so that two pilots cannot sit side-by-side, and if the pilot be wounded or should pass out, there is great difficulty in getting him out of his seat so that the bomb-aimer below or the top gunner behind can take his place.

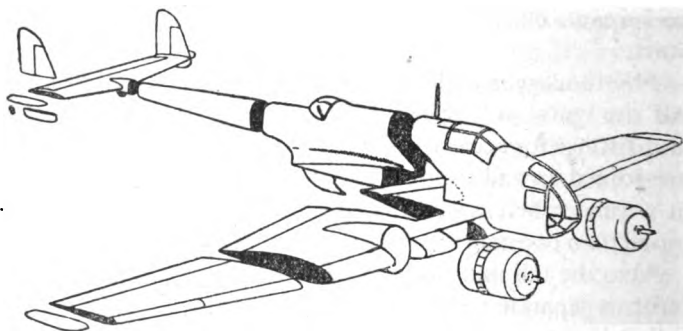


Diagram showing the major assembly units of the Hampden, which are built up separately before being rivetted or screwed together to make the complete aeroplane.

Even changing places when both pilots are well is difficult. Automatic gyro-pilots are now fitted which help somewhat towards safety and relieve strain.

Also, early in the war the Hampden was dangerously weak in armament, with one gun above and below at back, and one gun in front. By the ingenuity of the Staff at H.Q. of the Hampden Group, and of a private engineering firm, the Hampdens were modified and re-armed early in 1940 and thereafter did grand work.

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The Halifax

The latest Handley Page product which one may describe is the Halifax. Naturally no performance-figures may be given.

As the pictures show, it is a very handsome mid-wing four-motor heavy bomber, and it looks a small machine because of its good shape and proportions. The only figures which we can publish are: span 99 ft., length 70 ft., height 22 ft.

It has four Rolls-Royce Merlins of the latest type and it is the first British four-motor craft for a long time to have liquid-cooled motors. It carries very heavy defensive armament and armour—gun-turrets in nose and tail. It has slotted flaps, but no leading-edge slots, presumably because the official technicians fear ice on the leading edge and have not thought out a way of de-icing slots. The cabin is heated, but not the leading edge, so far.

At the end of the second year of war technical partisans in the Ministry of Aircraft Production are over-heating their slide-rules in argument about whether the Halifax or the Short Stirling is the more efficient or the more effective, considering speed, service ceiling, climb, take-off, loading per square foot, power-loading, absolute load carried, range, and so forth.

I give it up. All I know is that both are grand aeroplanes, and much better than any other country has. But I can vouch for the fact, having seen the performance which Mr. Talbot, the H. P. test pilot, gave on September 12th when Lord and Lady Halifax came to baptize the type, that the Halifax is a beautiful flying machine.

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SHORT BROTHERS

Short Brothers (Rochester and Bedford) Ltd., Rochester, Kent

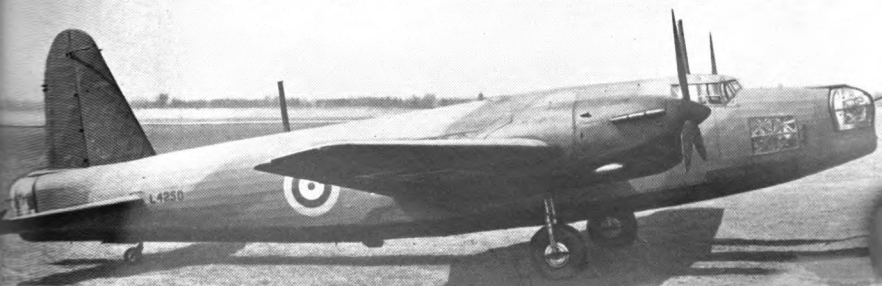
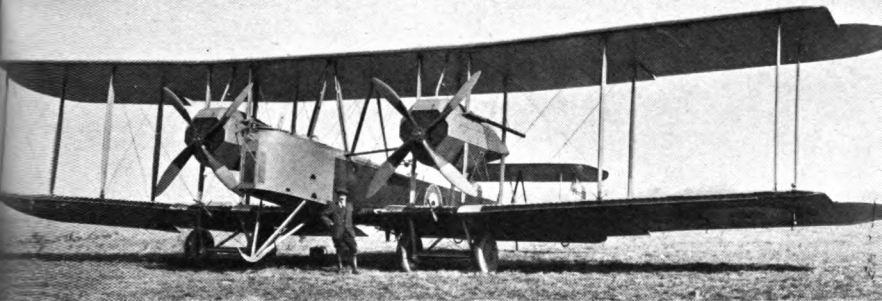
Years before anybody flew the brothers Short, Eustace, and Oswald, were making balloons in the arches under the Battersea Bridge Station of the London, Brighton & South Coast Railway, close to the Dogs' Home. Their eldest brother Horace, one of the greatest engineers of our time, was then working with the Hon. Charles Parsons (later knighted) on turbines at Newcastle-on-Tyne. Horace was in fact the man who made the steam turbine work. Also he developed the Auxetophone, which produced from a gramophone record a noise greater than that of a brass band, and was audible three miles away. One can switch off the B.B.C. when it becomes too banal or offensive but one could not escape the Auxetophone.

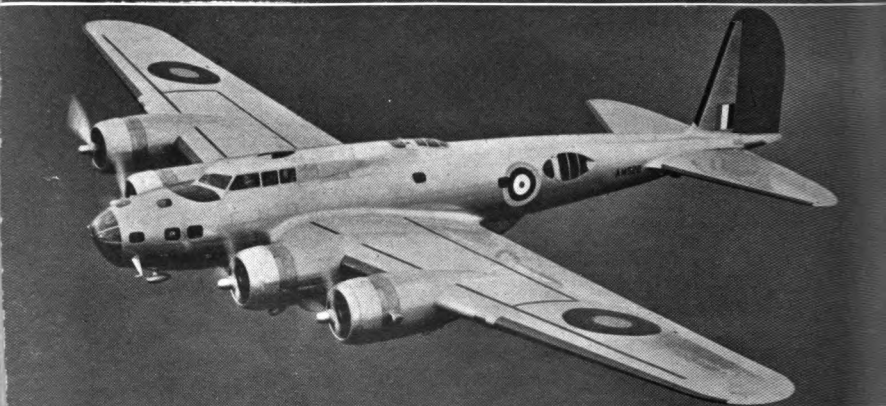
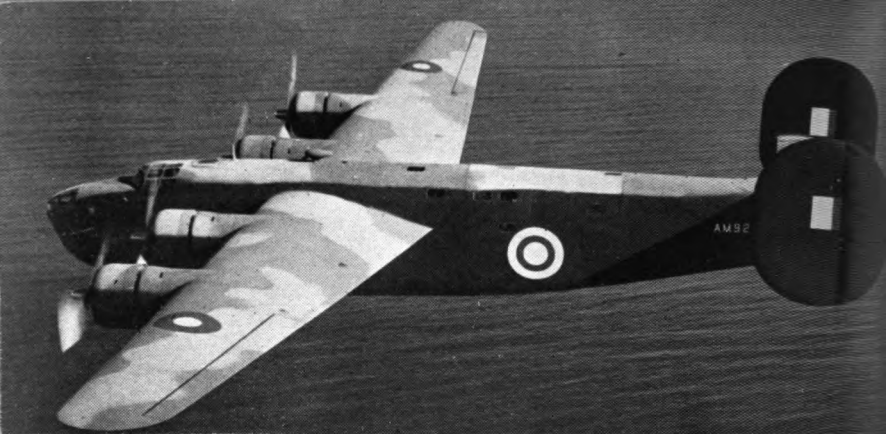
When the Wright Brothers first flew publicly in 1906, Mr. Griffith Brewer, their patent agent in England, introduced the Short Brothers, whose balloons he had habitually used, to them, and the Shorts became the Wrights' agents in England. And Horace descended from turbines to aeroplanes.

Horace was an amazing character. He had such a huge head that he had to have hats built for him. And that big head was full of brains. He was a fascinating talker and his line of humour was all his own. He invented words when he wanted them; for example the verb to 'spikebozzle'—meaning to thwart and ultimately destroy, which was current in the R.N.A.S. in the last war. He gave the name 'blimp' to the little R.N.A.S. non-rigid airships which consisted of a gas-bag with the fuselage of an aeroplane slung underneath. When asked why he called it a 'blimp' he replied, 'Well, what else *could* you call it?' And what could you?

Without question Horace was the head of the firm. Eustace,

Plate 13. Vickers Vimy (1917); Vernon (1924); Virginia (1923-30); and the latest type Wellington





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a charming person, was by nature rather an artist than an engineer and took little part in the business after Horace came to town. And Oswald was generally regarded as just the kid brother—a view which had to be altered when he built up the enormous organization which is Short Brothers (Rochester and Bedford) Ltd., to-day.

From the Battersea arches the Shorts moved to some marsh-land at Leysdown in the far east of the Isle of Sheppey (sheep-island); our pioneers favoured marshes and dump-land because they were poor.

There young Mr. J. T. C. Moore-Brabazon, on a French-built Voisin pusher box-kite, made the first flight in England round a closed circuit; not a circle but an irregular round course returning to the point from which he started. There also, on a pusher biplane designed and built by the Shorts, with a four-cylinder water-cooled Green engine of about 60 h.p. he flew the first mile in a closed circuit on an all-British aeroplane, and won £1,000 from the *Daily Mail* thereby. He also won the distinction of holding Certificate No. 1 of the Royal Aero Club.

At that time 'Brab' was one of the very few British drivers of racing-cars who could put up a show against the crack Continental drivers. He won the Circuit des Ardennes in 1907. In 1941 Lieut.-Colonel J. T. C. Moore-Brabazon, M.C., M.P., was appointed Minister of Aircraft Production.

The Hon. Charles Rolls, originator of the Rolls-Royce cars, had a Short-built Wright biplane at Leysdown. He was killed on a French-built Wright at Bournemouth in 1910.

Mr. Frank McClean, an Irish coal-owner, and a keen balloonist who became an aviator on a Short biplane early in 1910, bought a tract of sheep-land at Eastchurch in the middle of the Isle of Sheppey and the colony from Leysdown moved there early in that year. Frank McClean let the ground to the Royal

Plate 14. Big Americans: Consolidated Liberator; Boeing Fortress; Martin PBM 1; and Consolidated Catalina.

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Aero Club for one shilling per annum and all members had free use of it, to build their own sheds or rent those of the Club. And the Shorts' factory moved there too.

In 1911 Their Lordships of the Admiralty were graciously pleased to let three officers of the Royal Navy, Lieutenants C. R. Samson, Arthur Longmore, and Reginald Gregory, and one of the Royal Marines, Captain Louis Gerrard, draw full pay while learning to fly at Eastchurch. The Shorts built the box-kites on which they flew. Frank McClean paid for them. And Mr. George Cockburn, a pioneer pilot of the R.Ae.C., taught them free of charge. So the Navy did well.

That was a grand thing for the Shorts, for they got right in on the ground floor of Naval Aviation. Other officers of the Navy came to Eastchurch to fly, including the Engineer-Lieutenants who built up the technical side of the R.N.A.S., and quite soon Short Brothers Ltd. had become in effect the official aeronautical engineers to the King's Navy.

Naturally their attention soon turned to sea-flying. One or two French firms had got aeroplanes off water by mounting them on pontoons. In America Glenn Curtiss had used a canoe instead of pontoon floats and so had originated the flying-boat. The first flight off a ship was made by Lieutenant Arthur Longmore on a Short pusher box-kite which ran along a platform above the deck. He also flew from Eastchurch on a machine to which floatation bags had been fitted, alighted in Sheerness Harbour, went aboard a ship, taxied ashore, took off and flew home. Later Commander Samson flew off a ship steaming into Weymouth Bay.

A series of tractor biplanes on floats followed. Young Mr. C. R. Fairey was works manager. Gordon Bell, famous for his flying, his wit, and his stutter, was test-pilot; he was killed in an accident in France. All the Short seaplanes had folding wings, to make them handleable on shipboard. They did wonderful work hunting submarines, and in the Mediterranean as escorts to convoys, and in the Middle East as bombers.

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Then in 1915 a demand grew for aeroplanes to carry big bomb-loads, so some of the Short seaplanes, which originally had upper and lower wings of equal span, were mounted on a four-wheeled uncarrriage—there were no giant tyres in those days—and were given upper wings which overhung the lower wings by the width of a wing-bay on each side. And to pull all that each had one Sunbeam water-cooled engine of 225 h.p.—an engine which was quite reliable in one characteristic, all the valves had to be replaced after every flight of more than a couple of hours. Allowing for that peculiarity it did a lot of work.

One amusing feature of some of these machines was a machine-gun on a swivel on the upper plane. The gunner stood on the top of the cockpit to fire it over the airscrew. And nothing could fly slowly enough for the Short to overtake it when the gunner stood up. But they could and did lift loads of bombs.

In 1916 the Shorts built a bomber designed for the job. It had one 250 h.p. Rolls-Royce motor, the predecessor of the famous Eagle, later it had the Eagle, which gave 375 h.p. by the end of the War. The span of the machine was 85 feet; a foot more than a modern Whitley, and 16 feet more than a Hampden. It was 45 feet long, 15 feet high, had a 6-foot chord and a 6 ft. 3 in. gap. It carried twin machine-guns on a Scarff ring aft, and its offensive load was four 230 lb. bombs or eight 112 lb., or not quite half a ton. These survived till the end of the war.

By 1917 the firm had moved to its present works at Rochester. Also they had undertaken to build rigid airships, on the Schütte-Lanz principle, and for that purpose had built the great airship-shed and station and village at Cardington, near Bedford. Hence the firm's registered title. They gave up Cardington after the war and it became an R.A.F. airship station.

Horace Short died in 1917, deeply lamented, and a great loss to the nation, but young Oswald carried on the tradition. After the war, when orders for aircraft ceased, he took to building boats and barges for the Thames traffic. Later he built bus-

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bodies, largely for the London General Omnibus Company. And he told me with justifiable pride, in 1924 or 1925, when the aircraft business was reviving, that at no time had he fewer men on his pay-roll than he had at the peak of aircraft output on Armistice Day; surely a wonderful example of foresight and business acumen.

All this time he was experimenting with new ideas, and in 1923 or thereabouts he produced the first all-metal aeroplane—a normal type of two-seat biplane, but with metal spars and wing-covering and a metal fuselage. I believe that no other country had built a metal machine before.

When the R.A.F. began to grow again, through the efforts of Sir Samuel Hoare and Sir Hugh Trenchard, after 1923, Shorts took to building flying-boats for the Air Force. From them grew the great Empire boats, built for Imperial Airways Ltd., thanks to the vision of the Managing Director, George Woods Humphery.

In building them Shorts introduced a new idea. They built a small landplane called the Scion Senior, with four little 75 h.p. Pobjoy motors, which was an exact model or 'mock-up' of the big boats on a scale of 75 to 1,000, which was the h.p. of each of the Bristol Pegasus motors in the boats. Any defects in the controls were discovered and put right, and so when the first of the big boats came out it flew perfectly.

Before the war the R.A.F. ordered a lot of these boats, put in Frazer-Nash gun-turrets, stuck guns out all over them, and called them Sunderlands. They have done great work as bombers of submarines and as sea-scouts.

Also, before the war, came the fashion for outsize bombers with lots of engines. So Shorts were turned on by the Air Ministry (before the Ministry of Aircraft Production was conceived) to make one. They did with them as they did with the big boats, they made a flying mock-up. It was built in dead secrecy, almost on oath, under the Official Secrets Act.

On the day it was ready for test the small daughter of one of

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the head men of Shorts came running home from school to lunch, and, much excited, said to her father, 'Oh, Daddy, I hear that the little bomber is going to fly to-day. Can I stop away from school and watch it?' Amazement of poor Papa, who had been as secret as a Defence Notice.

The mock-up flew beautifully, and so did the first full-size machine when it appeared, and so have all its progeny. It is well armed, and carries a lot of bombs, and it is fast, so whatever may be the objections to big bombers the Short Stirling is as free from them as any aeroplane can be from criticism of one kind or another. At any rate a goodly number of stress and performance calculators are ready to vouch for its being the most efficient big aeroplane in any country, a claim which is only disputed by the Handley Page Halifax, at present.

The Stirling is a mid-wing monoplane, which has either four 1,400 h.p. British Hercules two-row radial motors or four 1,600 h.p. two-row Wright Cyclones.

The wing design is based on that of the G-type flying-boats, which were built for the trans-Atlantic mail services. The whole machine is built of metal. A novel, if minor, feature are the twin tailwheels, which retract neatly in front of the tail gun-turret. The very high main undercarriage retracts into the inner engine-housings.

It carries very heavy defensive armament and armour. The gun-turrets may be seen in nose and tail. The huge fuselage has storage for the heaviest bombs yet designed. The only figures we may publish are: span 99 ft., length 87 ft. 3 in., height 22 ft. 9 in.

In his uniform success Oswald Short has had the loyal backing of Arthur Gouge, one of the best engineers whom this country has produced. He started life as a workman at the bench, but by hard study in his spare time he qualified at London University as a Bachelor of Science, and by innate ability he became a director and in effect General Manager of Short Bros. Ltd. He has been loyally helped by A. H. Lipscomb, in charge

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of design and by J. Lankester Parker, the firm's test pilot, on whose criticisms and suggestions the Design Department rely. They make a fine team.

VICKERS LTD.

Vickers Armstrongs Ltd., Weybridge, Surrey

Vickers Ltd., an armament firm which ranked among the nations with Krupps in Germany, Skoda in Austria, Schneider-Creusot in France, or Bethlehem Steel in the United States before this war began, started in aviation at Brooklands during the winter of 1909-10. The moving spirit who persuaded the Vickers directors to go into this queer business was Captain Herbert Wood, of the 12th Lancers, a brother-in-law of Mr. McGarel Hogg, later Lord Hailsham, who was Lord Chancellor in 1929. Associated with him was Captain Peter Dyke Acland, an Indian cavalryman.

They took some sheds at the Byfleet end of Brooklands Track and began experimenting. They acquired a Farman box-kite and a Bristol box-kite and an R.E.P. (Robert Esnault-Pelterie) monoplane built of steel tubing covered with fabric. They also acquired an able and foresighted Edinburgh engineer, A. R. Low, who built some fascinating experimental types, and was himself a good pilot. Captain Wood flew with the facility of the born cavalryman, but was too busy to fly much.

They started a flying-school to which Captain Wood drew some of the best Army people, who later became important in the R.F.C. and the R.A.F. The chief instructor was Harold Barnwell, brother of Frank Barnwell, designer of the successful Bristol aeroplanes as far as the Blenheims, and the second instructor was A. M. Knight, a grand pilot and, incidentally, the only man I know who has been hit on the head by a revolving airscrew and lived.

Knight's teaching methods were as tough as his head, but there was no better teacher in the country. And he was strictly

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logical. One of the hazards at Brooklands was the Weybridge sewage farm. On a full circuit of the aerodrome machines flew across one corner of it. Whether the air over the sewage farm was thin, or the wet ground cooled the air and caused a down-current, we never knew, but the feebly powered aeroplanes of the time had a habit of descending suddenly into this morass. One such pusher biplane, on which Knight was flying with a pupil in front, had nearly crossed the hazard when it sank within a few feet of the low bank which bordered the bog. The pupil was thrown out, fell softly on his face, and spread-eagled in the mud. Knight, judging his distance neatly, used the pupil's back as a stepping-stone and came unspotted to land. The pupil struggled ashore in a mess, deeply impressed by his instructor's presence of mind. Brooklands was full of fun in those days.

Before war began in 1914 Vickers Ltd. had already built handsome workshops outside the motor track, but opening onto it, so that they could wheel their machines across it onto the aerodrome. They had built a pusher biplane with a gun in the nose, known as the Gun-bus, which did useful work early in the war.

When war broke out Captain Wood and Captain Acland were both called up to join their regiments in France, but they were pulled out by Vickers Ltd. to do more important work in making aircraft. But Herbert Wood was there long enough to see De Lisle's Cavalry Brigade hurled uselessly at barbed wire.

After their return the Vickers aviation business grew quickly. Branch works, with the worst possible aerodrome alongside, were started at Crayford in Kent. An aerodrome was made below Thames level at Joyce Green—and here Harold Barnwell was killed testing a high-speed pusher single-seat fighter biplane. An experimental workshop was built at Bexley Heath.

Vickers Ltd. also built rigid airships, on Zeppelin lines, at their shipyard at Barrow-in-Furness, where Captain Sueter, R.N., had superintended the building of the Navy's first aircraft, the ill-fated airship *Mayfly*.

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During the war Vickers acquired as works manager at their Weybridge Works, Percy Maxwell Muller, who was one of the pioneer engineers at Brooklands and had worked hard to make the Percival (N.B., not Edgar) biplane fly. It was called the *Oozeley Bird* because it whistled loudly and lugubriously when it did fly—because of something odd in the radiator.

Knight joined the R.F.C. as a sergeant-pilot, but later was pulled back to the works, where in charge of labour, he helped Maxwell Muller to push up a very big output, of the various types of machines, largely B.E.s and R.E.s designed by the Royal Aircraft Factory.

Towards the end of the war Rex Pierson, chief aeroplane designer of Vickers Ltd., produced the Vimy bomber with two Rolls-Royce Eagle motors. The first of them was too late to be used in the War 1914–18, but in 1919 the firm shipped one of them with two pilots, John Alcock and Arthur Whitten Brown, and a crew of mechanics to Newfoundland and they flew the Atlantic nonstop. A Curtiss flying-boat of the U.S. Naval Air Service had already done the journey by air, stopping at the Azores and at Lisbon. Alcock and Brown landed in Connemara, in the County of Galway, in the West of Ireland—so a flight from the Mainland of America to the Mainland of Europe was still to be done. Alcock and Brown were duly knighted. Ross and Keith Smith did the first flight to Australia in another Vimy and were knighted also.

From the Vimy Rex Pierson developed the Vernon and the Virginia, which was current as a big bomber almost till the war began. The Virginia had the distinction of appearing as our standard big bomber at all the R.A.F. Displays at Hendon.

In the meantime Sir Dennistoun Burney, who had made a fortune and won a knighthood by developing the anti-mine paravane from his early experiments with *pallettes*, or hydro-vanes, on a Bristol monoplane, had persuaded Vickers Ltd. to finance the building of a rigid airship for civil passenger traffic, in competition with the Zeppelin, which had flown round the

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world, and was doing constant trips to America. This ship, the R.100 was built at the former R.N.A.S. airship station at Howden, near York.

The designer was F. C. Wallis, who had invented what he called the 'geodetic system' of construction, which may be best described as a series of spiral structural members, starting from each end and running in opposite directions (right and left hand threads, as it were) so that they make a kind of basket or lattice pattern. So clever was the design that in that vast ship there were only nine different fittings, repeated over and over again, so that the construction became a mass-production job for a one-off output. The spiral members themselves were tubes built up of spirally-wound strips of Duralumin.

The engineer in charge was Neville Shute Norway, who later founded Airspeed Ltd., and is to-day famous as Neville Shute, one of our few brilliant novelists. The ship was the best ever built in this country. It flew in good time across the Atlantic to Montreal and back, commanded by Squadron-Leader Scott.

Meantime the Airship Department of the Air Ministry had built, at the former Short Brothers' shed at Cardington, the R.101—a ship which was hopeless from the beginning. It started for India, carrying Lord Thompson the Air Minister, who insisted on the ship's going, and Air Vice-Marshal Sir Sefton Brancker, Director of Civil Aviation, among the passengers. It sank to earth near Beauvais in France, caught fire, and all on board except three were burned to death.

Following that the Air Ministry fell into a panic about airships, and the good R.100 was ordered to Cardington. There it was hewn asunder with hack-saws and axes, the Duralumin debris was rolled flat by a steam-roller and sold as scrap metal—that was some years before Lord Beaverbrook raided the kitchen utensils of sentimental housewives for aluminium for Spitfires.

Appreciating the genius of Mr. Wallis and the cleverness of his geodetic design, the directors of Vickers Ltd. sent him to

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Weybridge, where, in co-operation with Rex Pierson, he produced first the single-motor Wellesley, three of which broke the World's Long Distance Record, and then the Wellington twin-motor bomber, which was soon recognized as unbeaten in any country for load carried in proportion to structure-weight.

When needed in quantities the geodetic construction proved hard to make quickly, so the directors of Vickers Ltd. fetched Trevor Westbrook, who had organized the Vickers-Supermarine Works at Southampton so that they turned out Spitfires like shelling peas, to the Weybridge Works, and he, as a production engineer, collaborated with Messrs. Pierson and Wallis to such good effect that very soon the Wellington became a first-class production job, largely put together by girls.

Some time later Trevor Westbrook resigned because of a disagreement with a director and he had to use his strongest personal influence to stop the workpeople at Weybridge from going on strike to get him reinstated. He joined Lord Beaverbrook in the Ministry of Aircraft Production, to look after the fettling up and modification of American airplanes. Later he went to the Middle East on an Army job of organization. And later again he rejoined Lord Beaverbrook at the Ministry of Supply.

The Wellingtons, now a thorough production job, were still pouring out from Weybridge and sundry other works which Trevor Westbrook had organized, and were doing excellent work in bombing German and Italian industrial centres and French seaports.

The original Wellingtons had two Bristol Pegasus Type XVIII motors of 965 h.p. each. With them its top speed was 250 m.p.h. Its cruising speed at 15,000 feet was 23·2 m.p.h. Its range was 2,840 miles. And its service ceiling was 24,000 feet.

Weight empty, 15,887 lb. Crew of five, 1,000 lb. approximately. Fuel (550 gallons), 4,114 lb. Oil (32 gal.), 288 lb. Service load, 4,148 lb. Disposable load, 9,550 lb. Weight fully loaded,

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